BETWEEN:

NORTHERN ELECTRIC CO. LTD. AND WESTERN ELECTRIC CO. INC. ..... PLAINTIFFS;

AND

JOHN CHARLES BURKHOLDER, L. A. KELLEY AND BURKHOLDER & KELLEY, LTD.... DEFENDANTS.

1934
Sep. 18, 19, 20, 21, 22 & 24.
1935
Mar. 13.

Patents — Subject matter — Anticipation — Prior art — Specification — Disclosure — Company — Infringement of Patent — Officers — Liability.

Held: That in order to establish that a patent has been anticipated, any information as to the alleged invention given by any prior publication must, for the purpose of practical utility, be equal to that given by the subsequent patent. The latter invention must be described in the earlier publication that is held to anticipate it in order to sustain the defence of anticipation.

2. Where the question is solely one of prior publication it is not enough to prove that an apparatus described in an earlier specification, could have been used to produce this or that result. It must also be shown that the specifications contain clear and unmistakable direction, so to

1935

NORTHERN ELECTRIC CO. LTD. ET AL v. JOHN CHAS. BURKHOLDER ET AL.

use it. It must be shown that the public have been so presented with the invention, that it is out of the power of any subsequent person to claim the invention as his own.

3. That the officers and directors of a company cannot be made liable for an infringement of a patent by the company, merely by reason of their position as officers and directors.

ACTION for the infringement of five patents assigned to the plaintiffs. The patents related to the simultaneous transmission of telephone and telegraph signals over a single pair of wires and the means employed for the separation of the electric currents conveying telegraph signals from those conveying telephone signals, with the minimum of interference the one with the other. The individual defendants are the officers and directors of the defendant company which made the installation which it was alleged infringed plaintiffs' patents.

The action was tried before the Honourable Mr. Justice Maclean, President of the Court, at Ottawa.

O. M. Biggar, K.C., and *R. S. Smart, K.C.*, for the plaintiffs.

E. G. Gowling for the defendants.

The facts are stated in the reasons for judgment

THE PRESIDENT, now (March 13, 1935) delivered the following judgment:

This is an action for the infringement of five patents which I shall presently mention. The case has to do with the simultaneous transmission of telephone and telegraph signals over a single pair of wires and more particularly with the means employed for the separation of the electric currents conveying telegraph signals from those conveying telephone signals, with the minimum of interference the one with the other.

So far as we are here concerned, telephony is carried on by the ordinary telephone arrangement whereby the sound energy of the voice, or music, impinging on the diaphragm of a microphone or transmitter causes the latter to vibrate, thus setting up vibrating electric currents in sympathy therewith. These currents are conveyed along the electric wires to the reproducing apparatus which in turn converts the electric energy back into sounds, intelligible to the human ear. The telegraphy is carried on not by the ordin-

ary means in which a direct current passing along the wires is interrupted into dots and dashes by a Morse key, but by what is called the "carrier current" system. In this system the signals are carried by a high frequency alternating current, the frequencies in this case being of the order of 5000 cycles for the outgoing signals and 7500 cycles for the incoming signals.

The transmission of both telephone and telegraph signals involves the transmission of electrical currents of varying frequencies. For the faithful transmission of music it is necessary to transmit electric currents of all frequencies between approximately 50 and 10,000 cycles per second, see *Western Electric Co.* v. *Baldwin International Ltd* (1), but for the transmission of intelligible speech a band of frequencies between 200 and 2,500 cycles will suffice. Telegraphy occupies a much smaller or narrower band of frequencies, namely, one of approximately 30 cycles for the automatic printer telegraphy, but in practice it is found necessary to allow a band of approximately 200 cycles in order to secure clear signals.

This controversy has its origin in the fact that the Ontario Hydro-Electric Commission had a telephone circuit between certain sub-stations at Toronto and Chats Falls on the Ottawa river, and thence down to Val Tetreau, P.Q. Over these wires they were sending telephone messages, but subsequently the defendants installed certain apparatus whereby the Ontario Hydro-Electric Commission now sends both telegraph and telephone messages simultaneously over this telephone line, utilizing the frequencies below 2,500 cycles for the telephone, and one band of frequencies at about 5,000 cycles and another at about 7,500 cycles, for the telegraph, and the contention of the plaintiffs is (1) that the means used to separate the low frequency telephone signals from the two high frequency telegraph channels constitutes an infringement of their patents, and (2) that the use of these means in combination with a vacuum tube repeater constitutes a further infringement.

Turning now to a brief statement of the means whereby electric currents of different frequencies may be separated from one another. These means are variously referred to as separators, filters, etc., but as the term "filter" appears

(1) (1933) Ex. C.R. 13.

1935

NORTHERN ELECTRIC CO. LTD. ET AL v. JOHN CHAS. BURKHOLDER ET AL.

Maclean J.

to be now in current use, and because it seems to express more precisely the process involved, I propose to use that term throughout my discussion of the case. Electric filters are divided into four classes and may be described as follows: A low pass filter is one which eliminates all currents having frequencies above a certain predetermined value. For example, if the filter is arranged for a frequency of 2,600 cycles it will pass currents of all frequencies from 0 to 2,600 cycles and reject those above that frequency. A high pass filter is the opposite of a low pass filter and is one which eliminates all currents having frequencies below a certain predetermined value, and to repeat our example, it would pass currents of all frequencies from 2,600 cycles to infinity and reject those from 0 to 2,600 cycles. A band pass filter is one which will pass currents having frequencies confined to a certain predetermined band, that is frequencies between two predetermined values, and which will eliminate all others. A band suppression filter is one which will pass the currents of all frequencies, except those in a band between two predetermined frequencies. This case is concerned only with the high pass and low pass filters.

Throughout the trial there was frequent reference to what is called the sharpness of the "cut-off." A filter which would cut off at a single frequency would be a perfect filter, but such excellence is not achieved in actual practice and it is found that, varying in different filters, a number of frequencies will be heard with diminishing loudness beyond the "cut-off" frequency. In other words the cut-off is not sharp, but the fewer frequencies that are heard after the cut-off frequency has been reached, the sharper is the cut-off, and the more effective is the filter. Electrical filters consist of a combination of capacities and inductances arranged in meshes or sections a number of which are connected in the line, and generally speaking, the greater the number of meshes included in the structure or network the more effective is the action of the filter. The various combinations used determine whether the filter is a high pass, a low pass, or one of the other forms of filter.

The plaintiffs are the owners by assignment of five Canadian patents which they claim the defendants have in-

1935

NORTHERN ELECTRIC CO. LTD. ET AL v. JOHN CHAS. BURKHOLDER ET AL.

Maclean J.

fringed. The first to be mentioned is patent no. 187,959, issued to Campbell on December 17, 1917, to be referred to hereafter as Campbell no. 1. The next is patent no. 269,137, a reissue patent, hereafter to be referred to as Campbell no. 2, and which was granted on March 15, 1927. The next is patent no. 216,852, issued to Osborne on March 14, 1922, and hereafter to be referred to as Osborne no. 1. The next is patent no. 269,136, issued to Osborne on March 15, 1927; this patent will be referred to hereafter as Osborne no. 2. And the last of the plaintiffs' patents said to be infringed is one issued to Reier on January 15, 1924, and numbered 237,090. The corresponding patents issued in the United States at dates considerably earlier.

Campbell no. 1 has to do with combinations of inductances and condensers of certain predetermined values and connected together in a specified manner to form closed resonant circuits, each circuit being referred to as a mesh. This patent claims that if a plurality of these meshes (each identical with the other) are connected together in series, and inserted in a wire circuit carrying electric currents of all frequencies, the structure possesses the ability to extinguish certain predetermined frequencies and to permit the balance to pass along the line without serious loss, or to use the technical term, without attentuation. The greater the number of meshes included in the structure or network the more perfect the operation of the filter, that is to say, the sharper the cut-off or dividing line between the frequencies passed and those extinguished.

Campbell, describing his invention in his specification, states:—

> This invention relates to an Electric Wave Filter and more particularly to a wave filter adapted to transmit with small or negligible attenuation sinusoidal currents of all frequencies lying within a range or ranges of preassigned limiting frequencies while attenuating and approximately extinguishing sinusoidal currents of frequencies lying outside the limits of the preassigned range or ranges.
>
> My invention, though it may find expression in many embodiments, has common to all the broad idea of a wave filter in the nature of a connecting line having an impedance element or elements in series with the line and an impedance element or elements in shunt across the line, the values of the impedance elements being so proportioned that the structure will transmit, with small or negligible attenuation, from a source of electromagnetic energy to an electrical receiving, translating or repeating device, sinusoidal currents of all frequencies lying within specified and preassigned limits or ranges while attenuating and sensibly extinguishng currents of all frequences lying outside such limits.

1935

NORTHERN ELECTRIC CO. LTD. ET AL v. JOHN CHAS. BURKHOLDER ET AL.

Maclean J.

My invention in one or more of its embodiments has important applications in connection with Wireless Telegraphy, Wireless Telephony, Multiplex High Frequency Wire Telephony, Composite Telegraph and Telephone Lines.

Of importance is his statement on page 2,

My invention is illustrated in the accompanying drawings in which Figure 1 is a diagram illustrating the broad form of my invention from which all specific embodiments may be derived by assigning proper values to the electrical constants of the structure; Figures 2, 3, 4, 5, 6, and 7 are diagrams illustrating different embodiments of my invention; Figures 8 and 9 show curves illustrating the characteristic performance of the wave filter; and Figures 10 and 11 are diagrams showing my invention embodied in telephone repeater circuits.

Like reference characters refer to like parts throughout the several figures of the drawings.

Referring to figures 1 to 7 inclusive, each wave filter 1^a, 1^b, 1^c, 1^d, 1^e, 1^f, 1^g, *is composed of a plurality of identical sections* 2^a, 2^b, 2^c, 2^d, 2^e, 2^f, 2^g, respectively each including lumped impedance in series with the line and lumped impedance in shunt across the line. Said impedance may be provided by condensers, C_1, C_2 or by inductance coils L_1, L_2, or by a suitable combination of both, there being at least, for each section of wave filter, an inductance element in series with the line and a capacity element in shunt across the line or *vice versa*.

And on page 3:

Said Figures 1 to 7 inclusive, merely show typical forms of the invention and are not intended to illustrate all of the possible modifications thereof.

His statement on page 7 is of particular importance:

It is not always desirable to transmit two bands of frequencies, and as a further refinement, my invention also contemplates a wave filter which will transmit freely all frequencies lying within a single band of specified limits. As will hereinafter be more fully set forth, the structures shown in Figures 2 to 7 inclusive will function as a single band wave filter, and the structure shown in Figure 1 may be made to so function.

He then proceeds to show how a single band may be secured, and he goes on to describe a second method of so doing, viz:—

The second method of realizing a single band wave filter is attained by relegating the upper band to infinity or the lower band to zero.

And on page 8, still discussing this single band feature, he states:—

(*f*) Making $L_1=C_2=O$ and thereby transmitting freely all frequencies above a specified value.

(*g*) Making $L_2=C_1=Oo$ and thereby transmitting all frequencies below a specified value.

Then on page 12 he states:

It will be further understood that the number of sections of the wave filter will depend on the degree to which it is desired to extinguish the currents to be filtered out. If the number of sections is doubled the ratio of the current of any particular frequency entering the filter to the current of that frequency leaving the filter is approximately squared.

1935

NORTHERN ELECTRIC CO. LTD. ET AL v. JOHN CHAS. BURKHOLDER ET AL.

Maclean J.

Then follows a complicated mathematical treatment of his arrangement which I do not pretend to follow and I must rely upon the expert witnesses for the conclusions resulting therefrom. Fortunately they appear to agree upon this. On page 13 Campbell works out an example for a band pass filter to pass voice telephone frequencies between 200 and 2,200 cycles, and the circuit arrangement to do this appears in fig. 10; and on page 15 he refers to his fig. 11 as showing a low frequency filter and a high frequency filter connected in series and he states that the low frequency filter may be omitted when there is no desire to suppress low frequency disturbances.

The plaintiffs rely on the following claims in this patent:

1. An electric wave filter consisting of a connecting line of negligible attenuation containing lumped impedance in series with the line and lumped impedance in shunt across the line, said impedances having precomputed values dependent upon the upper limiting frequency and the lower limiting frequency of a range of frequencies it is desired to transmit without attenuation, the values of said series and shunt impedances being so proportioned that the structure transmits with practically negligible attenuation sinusoidal currents of all frequencies lying between said two limiting frequencies, while attenuating and approximately extinguishing currents of neighbouring frequencies lying outside of said limiting frequencies.

2. An electric wave filter consisting of a connecting line of negligible attenuation composed of a plurality of sections, each section including a capacity element and an inductance element, one of said elements of each section being in series with the line and the other in shunt across the line, said capacity and inductance elements having precomputed values dependent upon the upper limiting frequency and the lower limiting frequency of a range of frequencies it is desired to transmit without attenuation, the values of said capacity and inductance elements being so proportioned that the structure transmits with practically negligible attenuation sinusoidal currents of all frequencies lying between said two limiting frequencies, while attenuating and approximately extinguishing currents of neighbouring frequencies lying outside of said limiting frequencies.

3. An electric wave filter consisting of a connecting line of negligible attenuation containing lumped capacity in series with the line and lumped inductance in shunt across the line, said capacity and said inductance having precomputed values dependent upon the upper limiting frequency and the lower limiting frequency of a range of frequencies it is desired to transmit without attenuation, the values of said capacity and inductance being so proportioned that the structure transmits with practically negligible attenuation sinusoidal currents of all frequencies lying between said two limiting frequencies, while attenuating and approximately extinguishing currents of neighbouring frequencies lying outside the said limiting frequencies.

* * * * *

7. The combination with a signaling circuit and a repeater therefor, of a wave filter inserted in circuit between said signaling circuit and said repeater for transmitting with practically uniformly negligible attenuation,

1935

NORTHERN ELECTRIC CO. LTD. ET AL v. JOHN CHAS. BURKHOLDER ET AL.

Maclean J.

between said signaling circuit and repeater, sinusoidal currents of all frequencies between an upper preassigned limiting frequency and a lower preassigned limiting frequency of a predetermined range of frequencies, while attenuating and approximately extinguishing currents of neighbouring frequncies lying outside of said range.

* * * * *

14. The combination with a signaling circuit and a translating device therefor, of a wave filter inserted in circuit between said signaling circuit and said translating device, said filter including impedances having values depending upon the upper limiting frequency and the lower limiting frequency of a prescribed range of frequencies, the values of said impedances being so proportioned that said filter transmits with practically uniformly negligible attenuation, between said signaling circuit and translating device, sinusoidal currents of all frequencies within said range of frequences, while attenuating and approximately extinguishing currents of neighbouring frequencies lying outside of said range.

* * * * *

16. The combination with a transmission line and a repeater therefor, of a wave filter inserted in circuit between said line and said repeater, said filter consisting of a connecting line having lumped impedances in series with said connecting line and lumped impedances in shunt across said connecting line, said impedances having values dependent upon the upper limiting frequency and the lower limiting frequency of a prescribed range of frequencies, the values of said series and shunt impedances being so proportioned that said connecting line transmits with practically negligible attenuation, between said line and repeater, sinusoidal currents of all frequencies within said range of frequencies, while attenuating and approximately extinguishing currents of neighbouring frequencies lying outside of said range.

Coming now to the second Campbell patent. Campbell no. 2 relates "to a special form of filter of the general type disclosed and claimed by my prior patents." The object the patentee had in mind was to increase the sharpness of discrimination between the frequencies that were to be transmitted and those that were to be suppressed. The specification states:—

The invention has among its objects the production of a wave filter which is capable of sharper discrimination between frequencies in the transmitted and suppressed ranges than the specific forms of filter which are shown and described as examples of the general type in said patents.

The invention comprehends as specialized forms ultra and infra filters, the former term designating a filter which suppresses frequencies above a definite limit, the latter being applied to a filter which suppresses frequencies below a definite limit. These two types of filters may also be distinguished as low pass and high pass, the low pass filters being those which pass low frequencies and the high pass filters being those which pass high frequencies. The limiting frequency between a range of passed frequencies and a range of suppressed frequencies is referred to as the critical frequency. On one side of the critical frequency is a transmission range of frequencies, and on the other side there is a range of suppressed frequencies.

And on page 6:—

It will further be noted that the lower portion of the descending branch of the solid line curves of Figs. 5 and 6 lies below the dotted line curve. This signifies that between the frequencies F_3 and F the attenuation of the filter of this invention is greater than that of the filters of my previous patents, while between the frequencies O and F the attenuation is less, F denoting the frequency at which the attenuation is the same for both filters.

And on page 10:—

Since filters must be finite in length it is necessary to determine the impedance with which a given filter should be terminated in order that it may behave as nearly as possible like an infinite network. It is obvious that this terminal impedance should be the same as the impedance of that portion of the corresponding infinite filter which has been neglected. This impedance is known as the "iterative impedance."

Campbell no. 2 shows five diagrams, numbered 2, 7, 8, 9 and 10, of networks of combinations of inductances and capacities which differ from the particular arrangements shown in the diagrams 1 to 7 in Campbell no. 1.

The plaintiffs rely upon claims 1, 3, 13 and 14; these claims it is conceded are practically the same, and Mr. Gowling admitted that if one were infringed they all were. Claim 1 reads as follows:—

1. A wave filter for electric circuits comprising an impedance element in series with the circuit and a capacity element and an inductance element in series with each other and in shunt to the circuit adjacent to the impedance element, said elements being so proportioned that currents of frequencies lying within a range of frequencies are approximately, suppressed by the structure, with a maximum of suppression at a frequency close to the end of said range, currents of other frequencies being transmitted with substantially equal freedom.

The next patent to consider is Osborne no. 1. This patent relates to the simultaneous transmission of telegraph and telephone signals over one pair of wires and the effective elimination of mutual interference. The specification states:

The means employed to eliminate said interference consists broadly of electric wave filters so designed and so associated with the telephone and telegraph circuits as to prevent low frequency telegraph currents from entering the telephone apparatus and also to prevent high frequency telegraph impulses from being transmitted from the telegraph apparatus to the telephone apparatus.

Osborne contemplates here the use of the band from 0 to approximately 200 cycles for the transmission of the telegraph signals, and the band from 200 up for the transmission of the telephone signals. Osborne's object was to show means whereby Campbell's high and low pass filters might be used simultaneously and multiplex communication be secured thereby.

1935

NORTHERN ELECTRIC CO. LTD. ET AL v. JOHN CHAS. BURKHOLDER ET AL.

Maclean J.

The plaintiffs rely upon claims 1, 14 and 15 in this patent, and Mr. Gowling conceded that they were practically the same. Claim 15 is typical of the others, and is as follows:—

15. In a transmission system a main transmission line having a plurality of branches, broad band wave filters in each branch, each wave filter comprising a plurality of sections, each section having series and shunt impedances, the impedances of one filter being so proportioned that a band of frequencies below an upper limiting frequency will be transmitted to one branch while frequencies above that limit will be substantially excluded, and the impedances of the other filter being so proportioned that a band of frequencies above said limit will be transmitted to the other branch and frequencies below said limit will be substantially excluded.

Osborne no. 2 amounts to a sort of reversal of Osborne no. 1. The objects of this invention are stated to be as follows:—

One of the objects of this invention is to provide a means for separating into different branches of a common transmission circuit frequencies lying to either side of a definite limiting frequency so that low frequency currents may be transmitted over one branch and high frequency currents transmitted over the other.

A further object of the invention has reference to the provision of means whereby a multiplex carrier system may be superposed upon an ordinary signaling line, such as a telegraph or telephone line, without necessitating any alteration or rearrangement of the low frequency apparatus normally associated with such a line.

Osborne no. 2, which has gone into considerable use, contemplates the telegraph channels in the band above the regular telephone bands, i.e., above 2,600 cycles, and contemplates the use of high frequency or carrier currents for the telegraph. This it might be here remarked is the general arrangement used by the defendants, that is, the telegraph signals are transmitted by carrier currents at frequencies higher than the ordinary telephone frequencies.

The claims relied on by the plaintiffs, in this patent, are 1 to 8 inclusive, and claim 1, which is typical of the others, reads as follows:—

1. In a transmission system, a main transmission line adapted to transmit both low frequency currents of an order lower than the upper limiting frequency employed in ordinary telephonic transmission and high frequency currents having frequencies of the order used in carrier transmission, branches leading from said line, one branch being adapted to transmit said low frequency currents and the other branch being adapted to transmit said carrier frequencies, means in the former branch to substantially exclude carrier frequencies while transmitting with substantially uniform attenuation a range of said low frequency currents, and means in the latter branch to substantially exclude said low frequencies while transmitting with substantially uniform attenuation a range of carrier frequencies.

1935

NORTHERN ELECTRIC CO. LTD. ET AL v. JOHN CHAS. BURKHOLDER ET AL.

Maclean J.

The final patent owned by the plaintiffs and said to be infringed is that of Reier, who, in his specification states:—

The principal object of my invention is to provide a new and improved wave filter having certain desirable operating characteristics. Another object of my invention is to provide a modification of a simple high-pass or low-pass wave filter that shall sharpen the cut-off between the free transmitting and attenuating ranges.

After a lengthy mathematical discussion he concludes:—

By my invention, it becomes possible to improve the attenuation characteristic of a high-pass or low-pass filter by a simple modification of a structure so as to sharpen the cut-off without altering the filter from an impedance standpoint.

Reier, which has also gone extensively into use, shows a new way whereby the different sections or meshes of a network containing unlike sections, that is, sections of different characteristics, may be connected together, thereby securing improved results in the sharpness of the cut-off. It will be recalled that the meshes contemplated by Campbell were identical meshes, and the problem which Reier sought to solve was how to make a filter consisting of a number of sections of one type, combined with sections of another type. The plaintiffs rely on the following claims in this patent:—

2. A wave filter having its cut-off sharpened by the replacement of a section thereof by a section of different type whereby its attenuation characteristic is made steeper near its critical frequency.

3. A wave filter having sections of different attenuation frequency characteristics, one section giving high attenuation over one frequency range and another section over another frequency range, whereby the composite filter gives high attenuation over both ranges.

The defendants alleged infringing structure is schematically set out in Exhibits 9 and 11. It will be seen that the main line conveying the combined telegraph and telephone signals is divided into two branch lines or paths. The first leads to the telephone apparatus and in it is inserted a low pass filter designated by the letter E. The second path leads to the telegraph apparatus and in this path is inserted a high pass filter designated by the letter D. After passing the high pass filter the telegraph signals pass through two other filters designated as B and C, respectively, and thence through a thermionic amplifier a rectifier, and finally into an apparatus designated as "D.C. Equipment."

The high pass filter D consists of three condensers respectively marked Ca, Cb, Ca, connected in series in one side of the telegraph path, and three similar condensers

1935

NORTHERN ELECTRIC CO. LTD. ET AL v. JOHN CHAS. BURKHOLDER ET AL.

Maclean J.

in series in the other side of this line, whilst across the line or in parallel with it there are two inductances marked on the diagram as La, La. The low pass filter E consists of four inductances marked Lb, Lc, Lc, Lb, connected in series with one side of the telephone path, and four similar inductances on the other side of this line, whilst in parallel with the line are connected two condensers marked Cc, Cc, and, in addition, what is referred to as a resonant shunt circuit consisting of two inductances marked Ld and Ld in series with a condenser marked Cb. Reference to the diagrams in Exhibits 9 and 11 will show how these instrumentalities are connected.

The amplifier, which follows the high pass filter D, consists of three audions connected in cascade whereby the output of the first audion is fed into the input of the second audion, the output of the second into the third, and thence into an appliance designated on the diagram as "Rectox Rectifier." The purpose of the amplifier is to amplify or strengthen the telegraph signals so that they may adequately operate the telegraph recording apparatus. The purpose of the low pass filter E is to accept or pass currents of frequencies below approximately 2,600 cycles, that is, the telephone currents carrying the voice signals, and to reject or refuse the frequencies higher than 2,600 cycles. The purpose of the high pass filter D is to accept currents of all frequencies above approximately 2,600 cycles, that is, those which are used for the carrier currents which convey the telegraph signals, and to reject all frequencies below 2,600 cycles, that is the telephone currents.

In comparing the defendants' structure with those disclosed in the patents sued upon we will first consider the defendants' high pass filter D. This consists, as before stated, of a number of condensers in series with the line, and of inductances in parallel such line, connected in meshes in a specific manner, and is the equivalent of the structure shown in fig. 6 of Campbell no. 1, which sets out a similar arrangement of meshes of condensers and inductances. In comparing diagram D and fig. 6 of Campbell no. 1, it should be noted that the fact that the defendants place condensers in the lower side of each mesh as well as in the upper, is of no moment, it being immaterial electrically whether the condensers are placed in either the upper or lower lines, or

in both; it is a question of the value of the capacity in each mesh. Hence, if Campbell no 1 is valid, claims 1, 2 and 3 are infringed by the defendants' structure.

The defendants' low pass filter E consists of two meshes of the structure shown in fig. 7 of Campbell no. 1 with the addition of a single mesh of the structure shown in figure 9 of Campbell no. 2, which the defendants have inserted in E between the two meshes of Campbell no. 1 just referred to. Again it is observed that the fact that the defendants place inductances in the lower side of the meshes as well as the upper is not of moment. The defendants' filter E therefore consists of a combination of unlike meshes, viz., two meshes of fig. 7, Campbell no. 1, and one mesh of fig. 9, Campbell no. 2. Reier also describes and claims a wave filter, one section of which is replaced by a mesh of a different type; hence, I think, if Campbell no. 2 and Reier are valid the defendants' structure E infringes them both.

Osborne nos. 1 and 2 describe arrangements whereby the main line conveying multiplex signals is divided into two branches one containing a high pass filter and the other containing a low pass filter. This appears in the defendants' structure where the main line is divided into two branches in one of which is inserted low pass filter E, and in the other high pass filter D; hence if the Osborne patents are valid, the defendants' infringes the same.

The last consideration on this aspect of the case, which I have deliberately postponed to this stage, is the combination claimed in Campbell no. 1 of an electric filter in conjunction with a repeater, and to which claims 7, 14 and 16 of that patent relate. The defendants' structure shows high pass filter D connected to a thermionic amplifier, and it was argued that this amplifier is not a repeater as described in this patent. I have given the best thought I could to this point and I have concluded that the repeater contemplated by Campbell is an apparatus whereby the signal in the form of electric energy is impressed on the input side of the repeater, and is repeated in an amplified form by the instrument and fed into the outgoing line, still in the form of electric energy, as distinguished, for example, from sound energy. This is exactly what the amplifier shown in the defendants' structure does. The currents are

1935

NORTHERN ELECTRIC CO. LTD. ET AL v. JOHN CHAS. BURKHOLDER ET AL.

Maclean J.

impressed upon the input and are fed out again into a line at the output, still in the form of electric energy, and it is not until these currents go through the translating device that they are converted into sound or mechanical energy, whereby the signals become intelligible to the senses. The fact that a pair of wires between the output of the amplifier and the rectifier and translating device, may be only a few inches long does not appear to me to alter the situation. It is convenient, no doubt, to have the amplifier, the rectifier, and the translating device in close proximity to one another, in fact they might be in the same box, but as far as the operation is concerned, the amplifier might be one or even a number of miles back along the line and in this case I think it certainly should be classed as a repeater. Therefore, if claims numbered 7, 14 and 16, in Campbell no. 1 contain subject matter, then the defendants' infringe them.

The chief defence here is that of anticipation. It was not seriously suggested that there was lack of utility in the patents in suit. Numerous references to the prior art were made on behalf of the defendants, and this might be a convenient stage at which to refer to the requirements of the law regarding prior art cited to establish anticipation. Two authorities were referred to by Mr. Smart and those I think are sufficient for our purposes here. In the case of *Canadian General Electric Co. Ltd.* v. *Fada Radio Ltd.* (1), it was held by the Judicial Committee, adopting my own language, as trial Judge in that case:

> Any information as to the alleged invention given by any prior publication must be for the purpose of practical utility, equal to that given by the subsequent patent. The latter invention must be described in the earlier publication that is held to anticipate it, in order to sustain the defences of anticipation. Where the question is solely one of prior publication, it is not enough to prove that an apparatus described in an earlier specification could have been used to produce this or that result. It must also be shown that the specifications contain clear and unmistakable directions so to use it. It must be shown that the public have been so presented with the invention that it is out of the power of any subsequent person to claim the invention as his own.

Then there is the case of *British Thomson-Houston Co. Ltd.* v. *Metropolitan Vickers Electrical Co. Ltd* (2). There the anticipation set up against the plaintiff's patent was one where the circuit diagram was an exact picture of the Rosenberg patent owned by the plaintiff, and with the same

(1) 47 R.P.C. p. 69; 1930 A.C. 97 at p. 103.

(2) (1928) 45 R.P.C. 1 at p. 24.

electrical connections, but they were to be used for a different purpose, and there was no suggestion in the earlier publication that those connections could be used for the purpose set forth in the plaintiff's patent, which was alleged to be infringed. Lord Dunedin discussing the prior art relied on by the defendant said:—

> My Lords, these three cases specially cited are quite at one as regards the law and they only differ because the facts differ. Taking the test I have already suggested, a man who, on the eve of the Brush patent, had said: 'I want to find a winding which will retain the advantages but get over the disadvantages of the series and shunt arrangements," and also had been handed *Varley's* patent, would invariably have said: "Why, here is exactly what I want." In *Otto* v. *Linford* and in *Flour Oxidizing Company* v. *Carr & Co.* he could have made no such remark.
>
> Applying this test to the present case, I do not think that anyone who was confronted, as *Rosenberg*, with the difficulty of getting a heavy machine into synchronism, and troubled with the too great consumption of current if the synchronized motor were turned on at once, and who, looking over older specifications which had to do with such machines, had come upon *Tesla's* Specification—I do not think that such a man would have been in the least likely to think that the solution of his problem had been provided for him. True he would, in the drawings, have seen two machines in series, but the reason suggested for that would have been the idea of getting both the machines at work, and there would have been no indication, or even hint, that the series arrangement, with properly proportioned machines, got over the difficulty of getting into proper synchronism.

The inference drawn from this by Mr. Smart was, that in the facts of this case, anyone wanting a high pass or low pass filter, at the date of Campbell's invention, would have found no anterior patent or publication which would tell him how to get exactly what he wanted. The same inference doubtless was intended to be drawn in the case of the other patents in suit. The authorities just mentioned accurately state, I think, what is the law.

I come now to a consideration of the prior art cited by the defendants in support of their plea of anticipation. They consist of published patents, text books, and other publications. This prior art was classified by the plaintiffs' witness Stevenson into four general groups, and, I think, we may accept this classification as being generally correct.

Group 1 covers patents and publications having reference to simultaneous transmission over a pair of wires, of telegraph and telephone signals, by battery or direct current, as distinguished from alternating current or carrier operation. The patents, with their numbers, included in this group are Van Rysselberg, 361,734; Van Rysselberg,

1935

NORTHERN ELECTRIC CO. LTD. ET AL v. JOHN CHAS. BURKHOLDER ET AL.

Maclean J.

363,188; Pickernell, 492,471; Pickernell, 512,214; Colpitts, 712,766; Athearn, 778,297; and Yorke, 845,157. The other publications are: American Telegraph Engineering Transactions, Vol. 29; American Telegraph Practice, McNicol (1913); and an article in the Telegraph Journal and Electrical Review, Vol. 10 (1882).

I have carefully examined all these patents and publications, and in none of them do I find any disclosure or claims which resemble, or which might lead to Campbell no. 1 or no. 2, or the other patents in suit. It was well known to the prior art that an inductance had the property of offering a resistance to currents of the frequency used in telephony, but would pass the direct currents used in telegraphy; on the other hand a condenser offers infinite resistance to a direct current and passes those of high frequency, and it seems to me that the object in all these publications was to secure or suggest better separation by a judicious use of the properties in the instrumentalities just mentioned. In no case can I find anything which might be construed as a network of sections, or any mathematical formulæ which might lead to the development of such networks as are to be found in the patents in suit, and generally nothing except the equivalent, at the very outside, of a single mesh of either Campbell no. 1 or no. 2.

Group 2 relates to publications having to do with tuned circuits, and the patents, with their numbers, are as follows: Stone, 714,756; Marconi, 757,559; Ehret, 789,124; Stone, 802,426; Davis, 808,438; Hutin & Leblanc, 838,545; Compos, 1,034,198; Vreeland, 1,171,813; Colpitts, 1,200,082; Vreeland, 1,224,342; Colpitts, 1,256,983; De Forest, 1,134,593; Squier, 980,356; and Espenschied, 1,578,495. The text book "The Principles of Electric Wave Telegraphy and Telephony" by Flemming, also falls in this group. All these publications relate to the separation of high frequency currents, that is to say, currents of frequencies much higher than those used for ordinary telephony, in fact radio or approximately radio frequencies.

The most important patents of this group and those on which, I think, the defendants relied, are Stone and Marconi, and Flemming's publication. All these have to do with the separation of radio frequencies and are in effect narrow band pass filters. The object of Stone and Marconi

was to select the signals of one radio station having a particular frequency, from one using an immediately adjoining frequency or wave-length, and the better to achieve this Stone proposed to use a series of inductively coupled meshes thereby achieving the reception of the desired station by sharpening the cut-off on either side of the band until it approximated a vertical sided narrow V.

The plaintiffs referred to this type of arrangement as a single frequency device, but, I think, this can hardly be so because recalling the evidence given before me in the *Alexanderson* case (1), and in *Western Electric Co.* v. *Baldwin* (2), I have the impression that there must be several million radio receivers in use to-day using this type of selection which must pass, if they are to reproduce satisfactory music, a band of frequencies at least 10,000 cycles wide. There is, however, in my opinion, based upon the evidence here, a wide and fundamental difference between an instrumentality which will at 1,000,000 cycles pass a band of 10,000 cycles, and one whch will pass all frequencies from 1,000,000 cycles to the infinite and reject all those below, or vice versa. Campbell achieves this, but I do not think it can be achieved by Stone or Marconi, and when the cut-off frequency is made as low as 2,600 cycles, I am satisfied that a network of the meshes of Stone or Marconi is not a practical arrangement.

The witness Kelley suggested that resistance introduced into the circuit would broaden out the V into a band, but once resistance is introduced into a filter it is no longer Campbell who contemplates a structure as free from resistance as is possible to obtain, and the fact that the defendants do not use Stone in filters D and E, which is the defendants' installation, with or without resistance, but does use Campbell no. 1, and a combination of Campbell 1 and 2, is indicative to me that there is a distinction between them, and that Campbell possesses qualities for this particular problem not found in Stone or Marconi.

We now turn to Stevenson's third group of the prior art references and which relate to what is called a "loaded line." The patents, with their numbers, are as follows: Kitsee, 766,451; Kitsee, 766,503; Kendall, 1,773,901; Pupin, 652,230; and Pupin, 652,231. The other publications are,

(1) (1927) Ex. C.R. 134. (2) (1933) Ex. C.R. 13.

1935

NORTHERN ELECTRIC CO. LTD. ET AL v. JOHN CHAS. BURKHOLDER ET AL.

Maclean J.

an article by Campbell in the Philosophical Magazine and Journal of Science, 1903, on "Loaded Lines in Telephonic Transmission"; an article by Pupin on "Wave Transmission Over Cables and Long Distance Air Lines" to be found in the Transactions of the American Institute of Electrical Engineers, 1900; and an article also by Pupin entitled "A Note on Loaded Conductors" to be found in the Electrical World and Engineer, October 12, 1901.

The invention of the loaded line is attributed to Pupin, and is an arrangement whereby the transmission of speech at long distances is materially improved. It was developed prior to the invention of the audion or vacuum tube repeater, and consists of the insertion in a telephone line of inductances of a certain definite value at certain definite intervals. Using an ordinary line, prior to Pupin, the relative high frequency speech currents became more and more attenuated as the line became longer and there was a definite limit to the distance over which intelligible speech could be transmitted. Pupin discovered that by inserting these inductance coils at proper intervals this attenuation could be reduced and the purpose of these coils, as stated by the witness Johnston, is to offset the effect of the capacity which exists between the line and earth, or adjacent lines.

Pupin, discussing mathematically the loaded line would appear to have laid some of the ground work on which Campbell built but he did not pursue the problem to any conclusion, and he did not discover what was afterwards disclosed by Campbell, that a loaded line is in effect a low pass filter with a cut-off at somewhere around 2,600 cycles. The whole object of Pupin was to improve the transmission qualities of the line and he does not appear to have considered the question of suppression of frequencies or anything in the nature of a filter action. His aim was to preserve frequencies and not to eliminate them. Campbell, in his patent no. 1 states:

> It should be clearly understood that my invention differs fundamentally both in structure and function from loaded transmission line systems. In transmission lines in which loading coils may advantageously be inserted, the attenuation is excessive and the sole purpose and object of the loading is to reduce the attenuation which normally exists in the unloaded line.

Pupin may have intended to extend his enquiry over the whole field, but there is no evidence that he did so, and

there is no discussion in his 1901 paper which would indicate that his investigations took him higher than the frequency of 750 cycles. I am of the opinion that Campbell cannot be found in Pupin's contributions.

Group 4 comprises certain miscellaneous patents. They are: Zobel, 1,538,964; Pupin, 1,541,845; Hoyt nos. 1,475,997 and 1,124,904; Kendall, 1,479,613, 1,773,901, and 1,459,709.

Zobel contains features of certain of the patents sued on by the plaintiffs. Mr. Smart practically admitted that Zobel and Reier were the same but that the latter having been filed in Canada in December, 1921, and the former having been published only in May, 1925, that therefore, under sec. 37 (*a*) of the Patent Act, Zobel could not be cited here as an anticipation even if it were applied for at an earlier date in the United States, and this view of the statute, I think, is correct. Pupin 1,541,845, is a device showing a number of resonant shunt branches separated by series resistances, and is accordingly not a filter of the Campbell type, which contemplates circuits of negligible resistance. The patents to Hoyt do not appear to have any reference to the separation of frequencies and are confined to balancing of loaded lines or to improving the transmission. The Kendall patents have to do with multiplex high frequency telephone systems and are cited against the Osborne patents; they show a combination of a band pass filter and a vacuum tube, the latter presumably being used to prevent inter-action between the different filters. Kendall states in his patent no. 1,459,709, at page 3:—

> In fig. 2 the unilateral device 17 performs an additional function in that it prevents any interaction between the filters in the various circuits. If the devices 17 were not provided, transients in one of the filters would serve to impress voltages on the other filters and also the efficiency of transmission would be reduced. But the unilateral devices 17 prevent any interaction of the filters.

This passage indicates, I think, that when Kendall was concerned with this problem he was of the belief there would be difficulties in connecting two filters in parallel and that the interactions of the one upon the other were of an unknown character, and that the connection of the two would make the action impossible of performance without running the risk of serious damage to the transmission properties. Kendall was apparently of the opinion then, that an arrangement or circuit such as suggested by Osborne

1935

NORTHERN ELECTRIC CO. LTD. ET AL v. JOHN CHAS. BURKHOLDER ET AL.

Maclean J.

would be inefficient. But the arrangement of Osborne is two filters connected together and allowed to react the one upon the other. Further, Kendall's fear of inefficiency is not apparently borne out by the actual facts. Mr. Biggar, in his opening, stated that Osborne had gone into use on quite a large scale in telephone systems and this was not controverted, but I understood admitted. It was said, that thirty-five or forty per cent of all filters in operation in telephone lines use Osborne's arrangement of connection.

The defendants contended that Campbell no. 1 is an intangible structure in that it contemplates an infinity of meshes, and that since it does not specifically set out how to calculate the resistance in which the last mesh must terminate to secure the best results, nor even mention the same, that it does not disclose all the particulars needful for its proper assemblage and functioning, and is therefore void for insufficiency of description. With this I cannot agree. In the first place, on page 13 of the patent, Campbell shows the formula for designing a filter which would transmit all frequencies lying between 200 and 2,000 cycles per second, and he states on page 14 that

> if five sections are employed the current of 2200 cycles in the 5th section is less than 2% of its value in the first section, while currents of frequency lying between 200 and 2000 cycles per second are practically unattenuated.

Further, in diagram 10 he shows a filter of four meshes connected to a vacuum tube repeater, all of which I think points to a finite arrangement. As to the terminal resistance, I understood from the explanations given by the expert witnesses that this is a question of matching impedances, which was discussed in the case of *Western Electric Co.* v. *Baldwin* (1); the submission of the plaintiffs was that Campbell being skilled in the art was familiar with this principle. Such I think must be admitted to be the case. Colpitts in his patent no. 1,129,959, dated 1914, sets out that:

> A well known law of electric circuits requires that the impedance of the external path of the circuit should equal the internal path.

And the defendants' witness Kelley admitted that the formulæ set out by Campbell in Exhibit 8, his 1901 paper, gives the same general result as that given by the witness Johnson in his book, though in a different form, and this Kelley admitted was one method of calculating the proper

(1) (1934) Ex. C.R. 132.

terminating resistance. In other words, it is reasonable to assume that, in 1901, Campbell was cognizant of the principle of matching impedances.

The remaining question for determination is whether the patents sued upon contain subject matter. The witness Johnson stated that 150,000 filters have been produced by or for the telephone companies,—it was not stated in what country or countries—and he stated that in that number 100 per cent comprised the idea in Campbell no. 1, 95 per cent comprised the Campbell no. 2 idea, 95 per cent the Reier idea, and 35 or 40 per cent the Osborne idea; while many of the five patents would appear to have much that is in common yet they are not identical arrangements. Campbell nos. 1 and 2, in my opinion, constituted a very considerable and useful contribution to the art and required the exercise of the inventive skill. Campbell was the first to conceive of the filtering properties of a series of recurring resonant circuits connected in the manner disclosed by him. It is true that Marconi and Stone, in their investigations and research work in connection with the new problems of radio, sought and succeeded in producing electric wave filters which possessed the virtue of accepting certain frequencies and rejecting others, but their whole effort was directed to a filter which would accept the narrowest possible bands at radio or high frequencies, but this was not the problem which concerned Campbell. Campbell's filter has the quality of being able to expand or narrow the accepted band of frequencies, or it can accept all frequencies above a certain value, or vice versa, which does not obtain in the arrangement of Marconi or Stone. In other words Campbell can do all that Marconi and Stone can do, but in addition much more. It was contended that claims 1 and 3 of Campbell no. 1 referred to only one section and not a plurality of sections, but claim 2 does, so whether claims 1 and 3 are valid or not would not seem to be of practical importance. I am of the opinion, however, that Campbell never contemplated a single section only, and this is made quite apparent, I think, from the portions of Campbell's first specification which I have earlier quoted. All the other patents sued upon, the two Osborne patents and the Reier patent, I think, are patentable improvements based upon the fundamental discoveries and mathematical treatment of the subject made by Camp-

1935

NORTHERN ELECTRIC CO. LTD. ET AL v. JOHN CHAS. BURKHOLDER ET AL.

Maclean J.

bell, and the networks which he disclosed; but Osborne and Reier were not, I think, apparent from Campbell. The inventions claimed in the plaintiffs' patents may seem obvious to-day, but it should be emphasized that the date of invention in each case goes back now many years, as will be observed from the dates of the applications for the patents, and in some cases the date of invention goes back beyond such dates.

In connection with the Osborne patents, possibly the evidence of the witness Johnson, well sets forth the problem facing anybody wishing to use filters in a system such as Osborne shows in his first patent. I quote from the evidence of Johnson:—

Q. Now going on to Osborne. What were the problems facing somebody who wanted to use these filters in a system such as Osborne shows in his first patent, where you are using the telegraph low frequencies and the telephone high frequencies?—A. The telegraph circuits involved the use of frequencies below a certain value and the telephone conversations required the use of frequencies above that same value. In order to get the maximum vitality of both telegraph and telephone messages and the speech it is essential that the frequencies used in the telephone channel be as wide as possible; in other words, that they go down as low in frequency as it is possible to go, or I should say, that it is practical to go, and, in the telegraph, in order to get good telegraph reception, it is again desirable to have as wide a band of frequencies as is possible. In the preceding art, where the use of such devices, such as were available before the Campbell invention, were used, it was not possible to get those two frequencies, one on one side limiting the telegraph channel and one on the other side limiting the telephone channel, very close together; in other words, there had to be a wide separation in order to get the necessary attenuation to keep the telegraph from giving what is known as Morse thump noises in the telephone channel and vice versa, the telephone interfering with the telegraph.

Then as to the question of the termination and interaction of the low pass and high pass filters respectively, Johnson stated:

The Campbell patents did not give any clue directly as to how the filters should be connected, if they were to be connected in parallel or series. They could be connected in parallel with certain terminations that would be inoperative and likewise connected in series with certain terminations also inoperative. If they were connected in parallel one filter might absorb all the energy that should go into the other filter and Osborn'e invention determined how those filters could be used in parallel, if they were connected in certain ways, and how they could be used in series, if connected in other certain ways, and he also found it desirable to have the cut off frequency of the low pass filter approximately the same as the cut off frequency for the high pass filter. This gave the telegraph channel as wide a band as possible and it did the same thing for the telephone channel and also gave certain advantageous characteristics which would not be expected before the combination had been tried out.

1935

NORTHERN ELECTRIC CO. LTD. ET AL v. JOHN CHAS. BURKHOLDER ET AL.

Maclean J.

Then a portion of the evidence of Johnson as to the problem Reier was attempting to solve might also be mentioned. He stated:—

Q. Are you familiar with Reier's mathematics?—A. I am.

Q. What would you say as to the simplicity of the problem, even from a mathematician's standpoint?—A. The problem is one, as it stood from knowing Campbell No. 1 and 2, that was by no means apparent, that you could connect sections together in the way in which Reier indicated and I think the fact that a good many engineers had knowledge of Campbell no. 1 and 2 for a good many years and did not appreciate they could be connected in the way he indicated, was pretty good evidence that the original concept was quite a difficult thing.

I have reached the conclusion that there is subject matter in all the plaintiffs' patents and that all the claims sued upon upon in each have been infringed by the installation made by the defendants, and in the defendants' installation, I think, is to be found, in one form or other, everything contained in the claims of the several patents here in suit.

The defendant corporation Burkholder & Kelley Ltd. was incorporated and organized in May, 1933, and it at once acquired the business and assets of the two first named defendants, who were carrying on the business of telephone engineers at Toronto, under the partnership name of Burkholder & Kelley. While the partnership was in existence Burkholder & Kelley entered into a contract with the Ontario Hydro-Electric Power Commission and the Gatineau Power Co. Ltd., to install the selective circuit which is said to constitute the infringement in this case. This contract was subsequently assigned to the defendant corporation and the defendant corporation made the installation complained of. The defendant Burkholder is the President of the corporation, and the defendant Kelley is Vice-President, and it would seem that they are sued because they are officers and directors of the corporation, at least there is nothing in the evidence which suggests anything to the contrary; Mr. Gowling argued this point on that assumption and counsel for the plaintiffs said nothing to dispel the suggestion, in fact they did not seem to press the point that the first two named defendants were liable at all. I do not think the designing of the circuit, or the making of the contract, by Burkholder & Kelley would constitute infringement. The installation was made by the defendant corporation and it alone is liable. The directors and officers of the corporation would not be liable for in-

1935

NORTHERN ELECTRIC CO. LTD. ET AL v. JOHN CHAS. BURKHOLDER ET AL.

Maclean J.

fringement. See *British Thomson-Houston Co. Ltd.* v. *Sterling Accessories Ltd.* (1).

Judgment will therefore be for the plaintiffs against the defendant company, and the plaintiffs will have their costs of the action. The action against the first two named defendants is dismissed without costs.

Judgment accordingly.