Further Analysis of Fading

In this further analysis of the fading reports "Megohm" gives some interesting material, and states that city listeners average more fades than country listeners. The question of land absorption is also death with.

PRELIMINARY REMARKS.

Numerous explanations have been given in the "Record" of the manner in which the modulated carrier wave is sent out from a broadcast station. Such a modulated high-frequency wave, analysed into its elements and studied in detail, is revealed as an intricate fabric of elemental waves, so interwoven with each other that none of them can be disturbed without changing in some degree the complexion of the whole. For perfect results the whole band must arrive at the receiver with an amplitude continuously proportional to that leaving the transmitter, or the expression of speech and music will not be correctly reproduced. All the component frequencies within the band must be unchanged in their relative amplitudes, lest the character of the sounds be altered. Even the relative phase relations of the various frequencies must be preserved, for it can be shown that otherwise the intersection of the two side bands in the receiving detector will result in the partial loss of some of the frequency components.

Put into simple language, this means that the complex broadcast wave must, in its passage to the receiver, meet with no influences that will change its shape or frequencies in the slightest degree, if reception is to be as nearly perfect as is possible. If the ether, the existence of which is presumed, was not contaminated by the presence in it of other matter of a denser type, the problem of undistorted transmission might be a much easier one. The ether, as supposed to exist, is a thing apart, yet pervades everything, and is a medium for the transmission of heat, light, electro-magnetic, and other vibrations not only around this earth, but from sun to planet, and planet to planet.

The electro-magnetic broadcast waves in their passage from transmitter to receiver have to encounter many influences not of the ether itself, and these obstacles may take the form of gaseous ions, a stratum of which forms the Heaviside layer, at a varying height from the earth, or it may be that varying composition or form of the earth itself has a detrimental influence, and there are others between these two extremes. It has been found in research connected with the Transatlantic radio telephone, that the earth's magnetic field, which is ever varying, has a considerable effect upon radio transmission, a magnetic disturbance tending to weaken night signals, and to slightly strengthen daylight reception. The actual effect of daylight upon very distant reception is too well known to need more than mention.

EFFECTS OF MAGNETIC DISTURBANCE.

The writer remembers during the transmissions from VLDN at the Dunedin Exhibition, reception in Wellington was normally fairly good, but one evening a group of friends were listening for a particular item to be presented about the middle of the programme. As the concert proceeded, a mysterious blurring came over reception, at times quite blotting out intelligibility. As the expected item approached, the distortion and fading became more intense, and apart from a snatch of the announcement very little of the solo came through, and the same trouble continued through succeeding items with more or less improvement. So mysterious and unusual was the trouble that the receiving set came under grave suspicion, but everything appeared to be in order. The newspapers next morning threw a light upon the mystery, announcing that on the evening in question a severe magnetic storm accompanied by a vivid display of the aurora australis, had raged in the south, being so severe as to put several land telegraph lines out of commission for the time. This happening is pointed out because it appears quite possible that such magnetic influences of lesser intensity may frequently be having some effect upon radio reception, although not making themselves manifest in other ways.

But there are other still more subtle and evasive influences at work, chiefly during night transmission, and it is around these that a great amount of speculation and experiment is centred. The theory of reflection of waves from an ionised gaseous surface known as the Heaviside layer, situated at about fifty miles above the surface of the earth, appears to be borne out by many experimenters, some of whom have been able to actually measure the strength of the reflected waves, which at night is added to the volume from those that travel at all times near to or through the earth. Another theory adds that the surface of this reflecting layer is in a constant state of undulation, an idea that appears quite feasible, and one that would make it impossible for a transmission to be received in exactly the same way at any two distant points, that is, both with regard to both the time of happening, duration, and intensity of fading or blurring, supposing it to be caused by a non-agreement in timing between the reflected wave and the earth wave. A great deal more might be said on the subject, but the chief matter now is to see what can be learnt from the reports that have been sent in.

FADING EXPRESSED IN FIGURES.

It is desired now to give a numerical expression of the amount of fading experienced in different parts, such numbers to be the direct result of the records on the charts. It is quite evident from the number of slight fades on some of the charts, and from the written supplementary reports accompanying very many of them, that in some cases the slightest detectable weakening of signals has been recorded. This is shown by the fact that a few reports mentioned that it was difficult at times to distinguish between fading and intentional soft passages in songs. It is thus seen that fading that may be classed as very slight and perhaps in long-distance reception quite negligible, depends very much upon the human factor. It was quite good for these fadings to be recorded, however, as they are helpful in conjunction with other reports.

Now when we come to consider the fading where volume decreases below half the normal, there is room for very little doubt or uncertainty, so it will be seen that on the whole the intense fading, more decided, but not so frequent in occurrence, will form a safe basis on which to build the decision now sought.

The total number of intense fades on each chart for September 26 have been counted in groups and the average for that group calculated, the result being the average number of intense fades per report. The list shows as follows, the average distance from 2YA being shown in parentheses:—

AVERAGE INTENSE FADES PER REPORT.

North Island.

North Auckland (350 m.)	4.4
Auckland City (300 m.)	10
Country, including South Auckland, Waikato, King Country, Rotorua, Thames, Coromandel, Te Awha (200 to 250 m.)	7.4
Taranaki (excluding New Plymouth) (125 m.)	5
New Plymouth (150 m.)	12
East Coast (Bay of Plenty, etc.) (250 m.)	3.2
Hawke's Bay (excluding Napier)	4.3
Napier	13

South Island.

Marlborough (50 m.)	Nil
Havelock, Rai Valley, Pelorus Sound only (50 m.)	7.5
Nelson district (100 m.)	11
Christchurch City (190 m.)	2.7
Canterbury (excluding Christchurch) (250 m.)	6
Westland (200 m.)	10
Dunedin (375 m.)	5
Otago (350 m.)	6.5
Timaru (270 m.)	7
Southland (450 m.)	4.7

From the above it will be noticed that, on the whole, receivers situated in the country get less fading than those in thickly populated areas. But notable exceptions are Christchurch and Dunedin, which both receive the wave from 2YA direct over water, the most favourable path.

Reports from Marlborough state that no fading is experienced there either night or day, but three separate reports from distinct parts of Marlborough-Havelock, Rai Valley, and Pelorus Sound show a considerable amount of fading, averaging 7.5 intense, but only three fades are shown on the Havelock report, so most are on the other two As these places are all situated within sixty miles of 2YA, or not further away than is Shannon, they appear to be worth special attention On looking at the map we find that the Pelorus Sound receiver is an air-line distance of 47 miles, and following this line from Wellington, it strikes land to the north of Tory Channel entrance, encounters the summit of Arapawa, 1593 feet, and further on, peaks of 978, 1531, and 1795 feet, all within about a mile of the line.

In the case of Rai Valley, which shows the most fades, there are peaks of 1762, 2095, 3183, 2288, and 2367 feet close on the air-line. This receiver is 63 miles from 2YA. A good detailed report was sent in, and has been compared with a similar one from Russell, North Auckland. There is agreement between the two in regard to the majority of fades and increase of volume, but the southern one also shows several intense fades that were not noticed even as faint ones at Russell, and some that were faint at Russell are reported from Rai Valley as "faded right out." It is quite clear that most of the fades were noted at both places simultaneously, but with different intensities. Apart from the peaks mentioned, the country traversed by the wave to reach this receiver is mountainous and irregular in the extreme At Shannon, an equal distance from 2YA, in a northward direction, no fading is experienced but a small amount of distortion is reported Daylight reception is not mentioned in the above report, but at Pelorus Sound is quite good. Mountains appear to have some influence upon night transmission, and if they have any upon daytime reception it must be of a different kind, or lessened intensity.

MANAWATU CONDITIONS.

Reception must be satisfactory at Palmerston North, for there are no complaints from that quarter, but, strange to say, from Feilding, only a few miles further, there are several complaints of distortion and mushiness, accompanied by intense fading. This appears to point to local conditions of some kind, either geographical or otherwise. As very few reports came from here, it is quite possible that most Feilding listeners are getting good reception, which is quite presumable, as Marton, a few miles further away, unanimously reports all well.

NELSON DISTRICT.

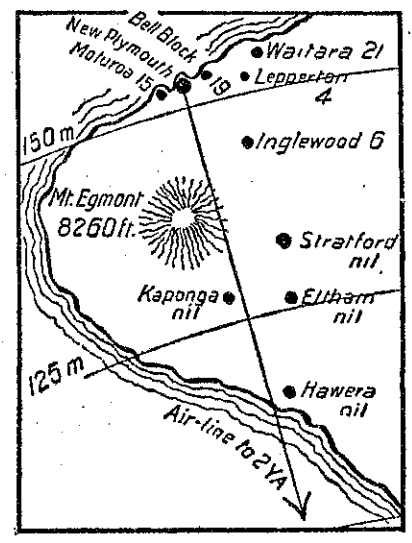
In the track of the wave from 2YA to Nelson City, there are peaks of 1762, 2095, 3183, 2288, 2367, 3420, 3976 feet, all within four miles of the air-line, so that so far as mountains are concerned, Nelson and the district to the west of it are well screened. This fact appears to be well borne out by the reports, which shows a larger number of intense fades than are experienced in other country districts. The average distance of this district from 2YA is 100 miles, Nelson being 60. Woodville, Hunterville, Wanganui, and Patea are about the same distance, and only from those places where transmission travels overland, that is, Feilding, Pahiatua, and Woodville, have there been reports of fading.

THE CASE OF NEW PLYMOUTH.

Authorities have placed the maximum distance for perfect and uninterrupted broadcast reception at from thirty to fifty miles from the transmitting station. This may be quite an accurate estimate based on careful experiment, taking the power of the station into account. It is found in practice, however, that passably good reception can be obtained at much greater distances than those mentioned, and upon a commercial basis a much larger distance must be covered by practically all broadcast stations at the present time, particularly in New Zealand, where a comparatively small revenue is called upon to provide four separate transmitting centres. When distance from the transmitter is accentuated by geographical conditions that weaken the signals received, it certainly becomes somewhat of a hardship, although natural conditions of many kinds must have to be suffered in many countries.

New Plymouth has been a source of insistent complaints regarding fading of transmission from 2YA, and an attempt is now to be made to show approximately the conditions of reception there.

The small plan herewith shows that New Plymouth is about 150 miles from 2YA, whilst Mount Egmont, frequently capped by an enveloping bank of



heavy clouds, lies almost directly in the air-line from 2YA.

It has been shown already in the case of Nelson district that a great amount of fading is experienced there, presumably on account of the mountain ranges over which the 2YA wave must travel. And Nelson district averages fifty miles nearer to 2YA than is New Plymouth. Looking through the reports for the two districts they seem in a general way to show a similar amount of slight fading. On reference to the plan it will be seen that practically no fading is experienced until the influence of Mount Egmont is added to overland distance. At Inglewood this effect begins to show, six fades being reported, Lepperton four, Waitara 21, and an isolated set at Bell Block 19. In New Plymouth town the average number is 12 intense fades per listener, whilst a single report from Moturoa, rather more in the radio shadow of Egmont, shows 15 intense fades.

A complaint from Hamilton which has been referred to "Megohm" suggests that the fading trouble is caused by the station itself. Perusal of a very interesting report of proceedings of the Institute of Radio Engineers of America shows results of experiments carried out in connection with fading Station variation does not enter into the question at all for it is shown that definite but irregular areas at a given distance from the transmitter are troubled with fading and distortion much more than other areas at the same distance. That fading can be caused apart from any possible variation at the station is made quite evident by the test now being investigated, there being frequent cases where one receiver registers a fade whilst another gets no variation worth noting. Putting the blame upon the station is quite a natural move for those who have not made a study of the question, and whilst it would perhaps be going too far to expect infallibility from any station, a great amount of fading or interference with the transmitted wave occurs during its passage through space.

SCRATCHING NOISES

TO FIND THE CAUSE.

Scratching noises in a radio receiver seem to be the noises that are prevalent in most sets that are noisy. These noises may be due to one or more of several causes. Those fans having sets that are scratchy will do well to read over the following list and then look over their sets for the points mentioned.

The first place to look for trouble is the aerial and earth. If there is any corrosion in any of the joints they should be taken apart and cleaned. Then resoldered. Any joint that is lers will cause any amount of scratchy noises in the phones.

Clean Valve Prongs.

The next place to look for trouble in this line is on the valve prongs. If there is any corrosion here it should be filed off and the prong preferably given a coating of solder. Use rosin as a flux in this case.

The binding posts on the sockets, rheostats, and other parts of the set, if loose, will cause scratchy noises. All nuts should be tightened with a pair of pliers to eliminate any chance of overlooking one nut.

Loose soldered connections in any of the leads in the set will cause scratchy noises and also clicks that are easily traced by touching the wires when the phones are in the circuit and the tubes lit.

Pigtails for Condensers.

Any friction bearings on variable condensers, variometers or vario couplers will cause any amount of scratchy noises. It would be better to put pigtail connections on all the equipment that now have this type of bearing and forego the necessity of cleaning the shafts and rods every time the set becomes noisy.

Scratchy noises are often due to loose phone connections. This is easily traced by shaking the phone cord while the phones are connected to the set with the tubes turned on.

CORRECT WIRING METHODS

There is all the difference between success and failure in the lay-out and position of the wiring of a set. Home-builders have even condemned the famous Browning-Drake circuit because they have not observed due precaution in the method of laying out the wiring.

The success or failure of a particular receiver usually lies in the radio-frequency part of the circuit and not as a rule in the audio-frequency end. Therefore, the home constructor should be extremely careful, in building any of the various Browning-Drake sets, to have the wires from the plate of the radio-frequency valve kept well separated from all other wires. This same statement applies to the connection to and from the balancing circuits and to and from the grids of the radio-frequency and detector valves.