

Reduction of Fading in Radio Communication

IT is now well known that part of the fading of signals experienced in radio communication is due to the variation of phase difference between the two or more sets of waves arriving at the receiver. These changes in phase difference arise in the course of transmission of the indirect waves through the ionosphere.

Two papers describing experiments demonstrating methods of reduction of this type of fading were presented early this year to the Wireless Section of the Institution of Electrical Engineers and are now available. The first paper, by Drs. A. L. Green and G. Builder, entitled "Control of Wireless Signal Variations", directs attention to the possibility, already known, of reducing variations in intensity of signals by combining the effects of two or more signals which have been transmitted on adjacent frequencies. After outlining the theory of the method, a description is given of experiments carried out between the University of Sydney and Liverpool, New South Wales, a distance of 25 km.

In this case, the fading was due to interference between the ground and ionospheric waves, and the curves accompanying the paper show that this fading could be considerably reduced by modulating the carrier wave at the transmitter, and integrating at the receiver the rectified current produced by the three sets of waves—carrier and two side-bands—so transmitted. The optimum effect is shown to be obtained when 100 per cent modulation is employed at a frequency dependent upon the path difference between the ground and ionospheric waves. A more complete control of the fading is obtained, however, if the carrier waves are suppressed, and only the two side-band waves are emitted at the transmitting station. Experiments carried out with this method have shown that fading, which under some conditions may be of the order of 85 per cent of the received signal amplitude, can be reduced to 5 per cent or less.

The second paper, entitled "Control of Phase Fading in Long-distance Radio Communication", by Drs. A. L. Green and O. O. Pulley, describes the extension of these experiments to greater distances. Measurements have been made at distances of 700 km. (Sydney–Melbourne) and 3,300 km. (Sydney–Perth) from the transmitter, and it was found that the phase fading was due to interference between two main ionospheric rays of comparable intensity. On account of the fact that the path of each of the ionospheric rays was subject to appreciable alteration during the day or night according as reflection takes place from the *E* or *F* region of the ionosphere, it was found desirable in these experiments to employ two modulation frequencies having a ratio of 3:1, the carrier wave being suppressed as previously described. The optimum control frequencies were found to be 200 and 600 cycles per second when the distance between transmitter and receiver was 700 km., whereas at 3,300 km. the best frequencies were 50 and 150 c.p.s.

The concluding portion of the first paper discusses briefly the possible application of these modulation methods of fading control to ionospheric research, to direction finding and to broadcast telegraphy and telephony. In connexion with telephony, it must be pointed out that the fading control does not apply directly to the audio-frequency components of the received waves, and a special additional modulation would be necessary to carry the intelligence. The possibility of the introduction of distortion would appear to make the application of the methods to high-fidelity broadcasting impracticable.

The investigations described in these papers formed part of the programme of the Australian Radio Research Board; in the absence of the authors, the papers were presented in London by Mr. J. A. Ratcliffe.

The Rehabilitation of British Agriculture

THE publication of the Minister of Agriculture's proposals for the assistance of agriculture in Great Britain gives greater pertinence to the three broadsheets on agriculture recently issued by Political and Economic Planning (P.E.P.). These broadsheets have been prompted by the desire to stimulate better informed discussion and the elaboration of a constructive policy in accordance with the position of agriculture in the national economy.

The first broadsheet deals with the demands of agriculture and the difficulties encountered by the various approaches to a balanced view. The Free Trade, Protectionist, Defence, Consumer and Employment approach are all briefly reviewed, as are those based on nutrition, amenities, industry, land maintenance and ownership. The broadsheet suggests that the types of crop and livestock to be produced by British agriculture should be those which the country is naturally best fitted to produce in relation to other countries over a long period. Arrangements are

necessary for the control of imports and for marketing the home output to smooth out fluctuations of supply and prevent sudden changes in prices. Subsidies or reliefs to agriculture are not objectionable in principle, provided they are open and under effective Parliamentary review and directed to the constructive development of permanent assets, not the bolstering up or development of production which is permanently uneconomic or tends to a retrograde type of farming. Great importance is attached to making British agriculture once more a flourishing industry by the achievement of superior competitive efficiency in supplying certain parts of the market. A thorough overhaul of agricultural production and marketing and of land management is required to be applied to technique in order to realize the advantages of a modern industrial structure. A parallel overhaul of country social and utility services is also required to counteract the rival attractions of factory employment and town social services.