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 firstbroad sheet 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.

In the second broadsheet the problem is approached from the consumer's point of view, and the need for further information about consumption habits in different areas and at different income levels as a basis for market policy is emphasized, as well as the importance of making the necessary economic adjustments to enable British agriculture to take advantage, so far as possible, of demand changes in its favour and to minimize the repercussions of other changes in demand. Needs in distribution are summarized as assembling and placing at the disposal of the consumer a suitable supply of the products demanded, at convenient times, at the lowest possible cost and at prices he can afford, and carrying out a large range of ancillary services such as delivery and credit. The value of concentrating demand where possible and of steady contracts is stressed, as well as the opportunities of developing rival industries, and the importance of efficient organization in the farming units if the good will and support of the urban electorate are to be held. The Marketing Boards have as yet scarcely touched the major problems with which they are confronted of expanding the market for home produce, increasing the return to the farmer, and reducing the cost to the consumer through savings in transport and distribution, or gaining for the farmer a larger share in the profits of processing his output or in reducing the contribution to the profit derived by supplying him with fertilizers, feeding stuffs and seeds.

The third broadsheet, dealing with the farm and of agriculture, emphasizes that the industry has far too many diverse elements and is affected by too many other activities at home and abroad for any one formula or panacea to offer a solution of its problems. Determined criticism of all one-sided approaches or ideas is indispensable. British agriculture is also regarded as having lost the close touch with the consumer demand which it had when the market was smaller and more static. The necessity for adapting agriculture as an industry in which the landowner and land agent, the farmer, agricultural engineer, the veterinary officer, marketing expert and other specialists can effectively work together is also stressed, as well as that of continuous local leadership. A stable rural basis for agriculture can no longer be assumed, and only an all-round policy of rural reconstruction can save British agriculture as a living and growing organism. Stable prosperity for farmers, it is suggested, can only be secured by types of farm and methods of farming designed to give the maximum net return each year over a long period. Agricultural subsidies and assistance should have for their objects urgent salvage or relief work of an essentially temporary nature for badly hit branches of the industry; permanent re-adjustment of the balance between town and country life, through subsidizing of rural roads, telephones and social services; and long-term development, such as improving farms and buildings, improving stock and eradicating disease, increasing the fertility of the soil, afforestation, land drainage, and information services. Particular stress is laid on the importance of increased expenditure on research.

Bantu Blood Groups

IN a comprehensive study of the blood groups of the Bantu of Southern Africa by Mr. Ronald Elsdon-Dew (*Pub. South African Inst. Med. Research*, **7**, No. 39), a suggestion is made, based on this line of research, as to the early racial history of the African peoples.

Five thousand recruits for the Witwatersrand mines, grouped according to Bantu tribal origin, were submitted to the blood test. On this evidence it would appear that the Bantu are not homogeneous from a serological point of view; but as a whole they show a position close to the origin in the predominance of *O*, a position unoccupied except by such races as the American Indian, and indicating a more primitive distribution of the groups than is found in any other black race of which the figures are known. The known crosses of Caucasoid and Negro as exemplified in Algeria and Tunis occupy a position midway between the Caucasoid races and the origin. The Berber peoples show a small proportion of *B*, but they have a proportion of *A*, which gives them a type of distribution found in certain races separated early from the stock of mankind, such as the Australian aborigines. The Bush race shows a similar arrangement, while the Hottentot lies between the black races and the Egyptians.

The Southern Bantu are found to fall into three main groups, a primitive group, an intermediate group and a Caucasoid group. In the Caucasoid group fall the Mpondo and Xhosa. In comparison with other groups, this must have absorbed a considerable proportion of Caucasoid blood. The Bushman-Hottentot complex could have had this effect, and this agrees with the fact that Mpondo and Xhosa show culturally and linguistically the results of Bushman-Hottentot contact to a greater extent than is shown by the other races. The intermediate group comprises Zulu, Shangaan, Tswana and Southern Sotho, corresponding roughly to the Nguni group. The primitive group comprises on one hand the Tchopi and Inyambane, about whose separate entity there is no doubt, and on the other hand the Swazi and Northern Sotho, whose position needs further investigation with reference to the Bantu as a whole, and the alleged primitive black race. If, as is usually held, the Bantu is derived from a Negro stock with Caucasoid (Hamitic) admixture, it is remarkable that serologically it should be more primitive than the Negroes of West Africa, a fact which suggests to the author a revision of early African racial history.

At some early date Africa was inhabited only by a black race, probably living near the west coast, and composed solely of the *O* group, as *A* and *B* had not appeared at the time it separated from the main stock. Africa was then invaded by a light-skinned small race bearing the factors *B* and *A*, which moved south, forming the Bushmen. A taller, light-skinned race with the factors *O* and *A* then arrived, but remained in the north, forming the Berber race. Then came a race with all the blood-groups which