ECHO TYPE WAVEFORMS WHICH APPEAR TO EXHIBIT THE EFFECT OF REFLECTIONS FROM TWO LAYERS IN E REGION.

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Illustrations are given of a special type of night time waveform which were recorded in June 1955. The type of waveform with which this investigation is mainly concerned is that showing two series of discrete pulses arriving by different modes of reflection between the earth and the ionosphere. of 545 echo type waveforms, 86 (16 per cent) were classified as this type without any doubt. To clarify this type ten examples in which the peaks are particularly well defined will be shown in Fig. 1 to Fig. 10.

In the inspection of these waveforms it is found that the intervals between the peaks of the identified orders increase with orders of peaks. If we consider those two series of peaks as the pulses originated from the multiple strokes, the intervals between peaks of identified orders must be constant independent of the orders of pulses. Therefore assuming that there are two parallel layers in the E region, and that the height of upper layer is 80 km, the lower one 75 km, the author tried to find whether these figures fit into the simple reflection picture and are explained in terms of the ionospheric reflection from two layers situated several km apart.

The method used in determining the distances of sources involves the use of a chart having two series of curves corresponding to heights of reflection 80 and 75 km, and showing the relationship between the time-delay of the echoes and the distance of the source.

An estimate of distance is in general possible, and the accuracy is found to be higher than in the usual echo type waveforms. Whatever is the cause of these forms, the result is to decrease the difficulty of analysis. HORNER suggested as follows; an analysis of the waveforms indicates that energy was reflected at heights of 77 and 85 km. But our results are different from such a picture because peaks of any series cannot be reflected irregularly from both layers but from only one layer respectively.

In Figs 11 and 12 other examples observed in March 1956 are presented. The appearance of these waveforms are similar to the previous figures. In these waveforms the interval between the heights of layers was found to be about 6 km by the waveform analysis. It is to be noted that the waveform analyses of such type lead to an accurate value for the distance of the source because of having two series of pulses.

The author tried to reexamine the distance and the height of ionosphere from a waveform reported by RIVAULT. (Note preliminaires du L. N. R. No. 65) The figure is shown in Fig. 13. He derived that it originated at a distance of 1,300 km and that the height of the reflecting layer is

Fig. 1.

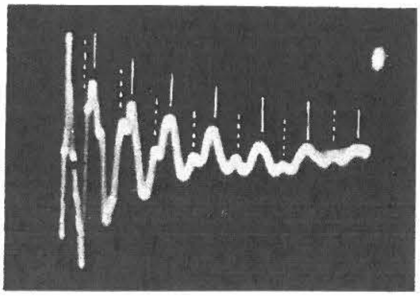


Fig. 5.

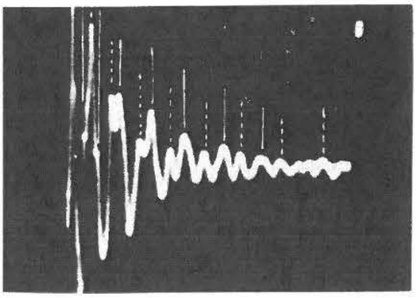


Fig. ' 2.

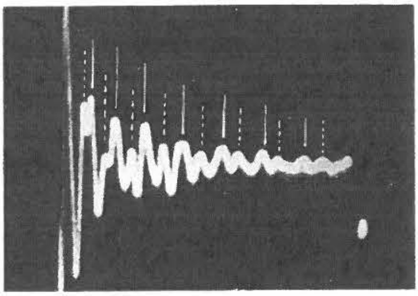


Fig. 6.

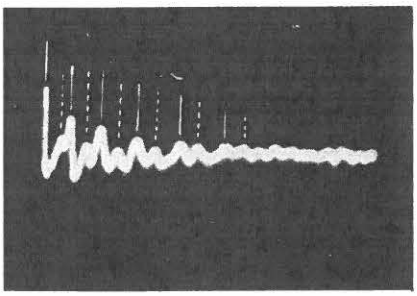


Fig. 3.

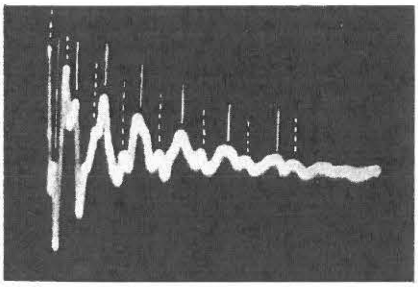


Fig. 7.

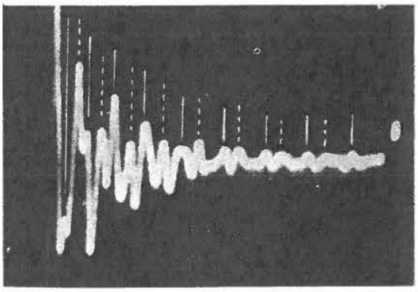


Fig. 4.

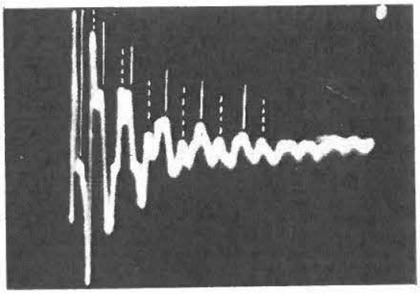
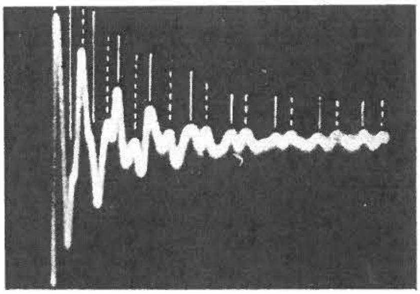


Fig. 8.



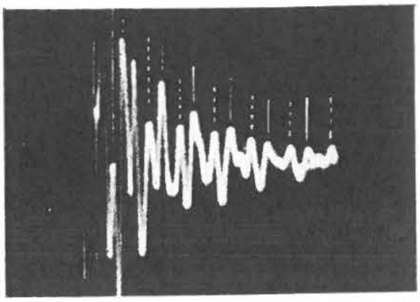


Fig. 9.

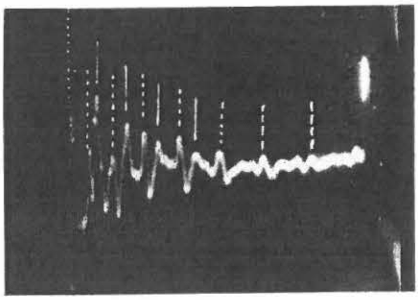


Fig. 11.

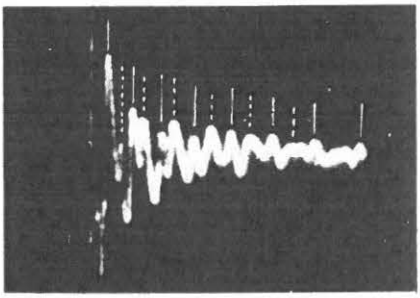


Fig. 10.

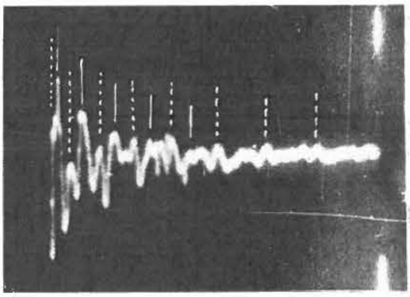
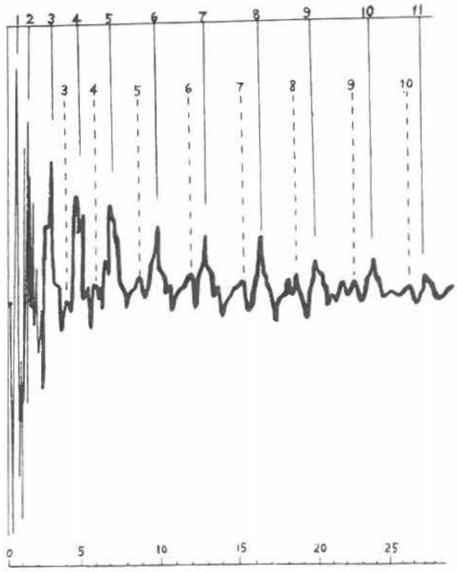


Fig. 12.

Fig. 13.



75 ± 1 km from the waveform analysis. Each full line indicates the order of peak adopted by him, while the dotted line is the one adopted by the author. Though the amplitudes of peaks indicated by dotted lines are rather small, those peaks are clearly defined and the author could derive the identical distance of 1,300 km and another height of 82 km using a series of peaks indicated by dotted lines. The height of 75 km derived by RIVAULT seems, therefore, to be the height of a lower layer.

In this paper, however, amplitudes of the reflected peaks could not be investigated as well as the theoretical treatment of the reflections from two heights, differing by a few kilometres.

Finally, the author wishes to express his gratitude to Director KIMPARA of our Institute for his constant encouragement and advice.