termined. Under existing pollution conditions, there are but few occasions in the summer when the residual oxygen exceeds nil. Varying numbers of *Eurytemora* are usually present in the river water when sampled, and are thus included in the sample put aside for this test. The following table gives a record of the ensuing mortality on these included copepods for certain dates during 1930:

Date sampled.	Oxygen *in situ* (gm. per 100,000 gm.).	Oxygen remaining after incubation (gm. per 100,000 gm.).	*Eurytemora.*
May 23 .	0·44	0·045	Most alive, some dead.
May 30 .	0·24	nil	All dead.
June 6 .	0·26	nil	All dead.
June 13 .	0·14	nil	All dead.
June 20 .	0·33	nil	All dead.
Aug. 1 .	0·50	0·004	Most dead, a few alive.
Aug. 8. .	0·76	0·45	All alive.
Aug. 15 .	0·74	0·006	Few dead, most alive.
Sept. 5 .	0·58	0·004	7 present at start, 7 still alive.

It is to be noted that on four of the nine occasions the dissolved oxygen has been completely utilised by oxidisable matter, and no *Eurytemora* remained alive. Toxic substances may have exerted an influence in addition to oxygen deficiency. It is evident that, although the copepod is regularly taken in the river under such conditions, it can survive total oxygen deprivation for short periods only. Its presence in the river at these times may be explained by the continual slight aeration of surface waters by river traffic, slight though the effect may be. It is clear from the table that this copepod may survive in brackish water, heavily polluted, when the oxygen concentration is no more than 0·004 gm. per 100,000 gm.

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Feb. 7.

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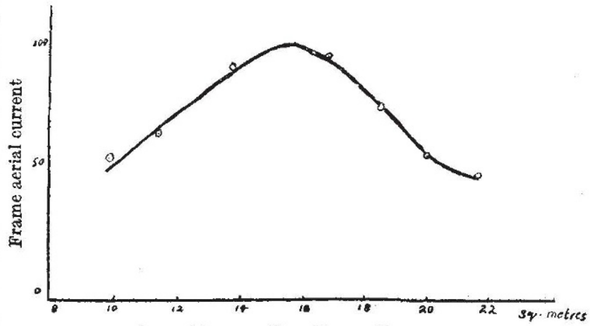
Optimum Dimensions of Short-wave Frame Aerials.

BECAUSE of the increasing use of short waves in present-day wireless practice, many investigators have studied the nature of the electromagnetic field at distances less than a wave-length from a radiating antenna. The importance of such investigations lies in the fact that a knowledge of the peculiarities of the field at these short distances enables designers of directive beam aerials to space correctly the units of the radiating and receiving systems. For example, for maximum forward radiation the critical spacing between a line of tuned radiating antennæ and a line of tuned reflecting wires is now known to be 0·33 or 0·85 of a wave-length and not 0·25 of a wave-length as was originally supposed.[1]

The erroneous argument which leads to the result that 0·25 of a wave-length is the best spacing between a Hertzian dipole oscillator and a reflecting antenna behind it, also leads to the conclusion that the best width of a frame aerial is 0·5 of a wave-length. A more rigorous theoretical treatment shows that, for a frame aerial, there are several different critical widths and heights which depend upon the wave-length in use, and that none of these critical values is half a wave-length. Although the critical dimensions are of little consequence in long-wave work, they are of outstanding importance in the design of frame aerials for short waves, because the resulting current for tuned aerials can be increased many thousand-fold by designing the frame with the optimum dimensions. Thus a square or circular frame is always less efficient than a correctly proportioned rectangular or elliptical frame of the same area.

Since both the optimum width and height are dependent on the wave-length, it follows that the optimum area of a frame is also critical when used for wave-lengths comparable with the dimensions. In the current literature it has been assumed hitherto that the larger the area of the frame, the greater will be the radiated power or the received current, but this is not so for short waves. Investigations upon which we are now engaged have shown, for example, that it is possible to double the area of a tuned frame without increasing the signal strength, even when the ratio of the height to the width is the optimum value for the particular wave-length in use. This is shown in the accompanying graph (Fig. 1), which is based



Area of frame with optimum dimensions

FIG. 1.

on measurements made on 8·65 metres with a tuned frame capable of being expanded in either or both dimensions. The current values are those obtained when the frame was adjusted to its optimum dimensions, and hence the currents recorded are the greatest that can be obtained with a frame of the given area. Thus the greatest possible current was approximately the same whether the area of the frame was 10 or 20 square metres, and this current was reduced by any change in the relative dimensions of these frames. The critical area was between 15 and 16 square metres, and then the maximum current exceeded that for frames of any other area. In all cases the frame was tuned to 8·65 metres.

A further point of interest is the fact that a frame designed for best reception on a given wave-length is not the optimum shape for maximum radiation on the same wave-length.

As we have ventured to think that these preliminary results may be of some interest, it was thought desirable to write this brief note now, but it is proposed to publish the work in detail shortly, when the theoretical and experimental investigations now in progress are completed.

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Hull, Feb. 26.

[1] See publications in Great Britain by Wilmotte and McPetrie and by Palmer and Honeyball, in the United States by Englund and Crawford, in France by Mesny, Chireix, etc., in Germany by Meissner, Gothe, and others, and in Russia by Tatarinoff and also by Pistolkors.