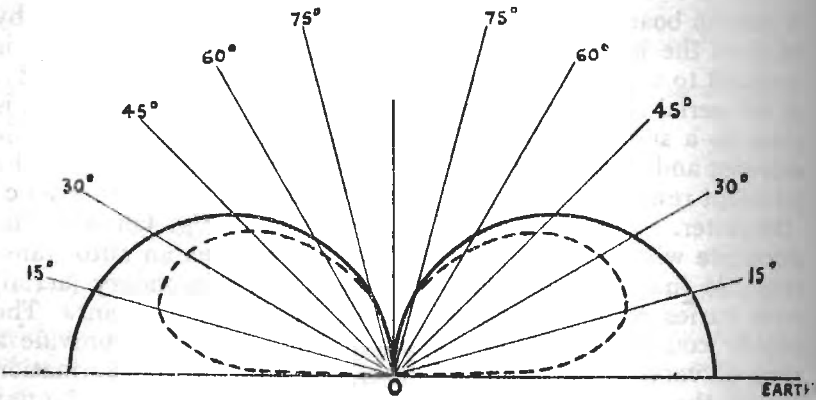
771. Distribution of Radiated Energy.—Before the possibility of long-distance communication by short waves was realised, attention was mainly confined to the amount of energy radiated from an aerial on different horizontal bearings. The radiation from a vertical aerial, as would be expected, is symmetrical in this respect, and takes place equally in all directions, but many aerial systems have been devised to give a maximum amount of radiation on one particular bearing and little or none on other bearings. Such "directional" transmission will be further mentioned in the next chapter.

The increasing use of the indirect ray (the radiation which travels up into the Heaviside Layer in its passage between transmitter and receiver) leads to the necessity of discovering how the radiation from an aerial varies at different vertical angles. For instance, in point to point long-distance transmission at high frequencies, suppose that we know the great circle bearing of one point from the other, and also the best frequency and angle at which radiation should enter the Heaviside Layer in order to give the required signal with minimum attenuation ; a basis is then provided for designing the most efficient aerial system to satisfy these requirements.

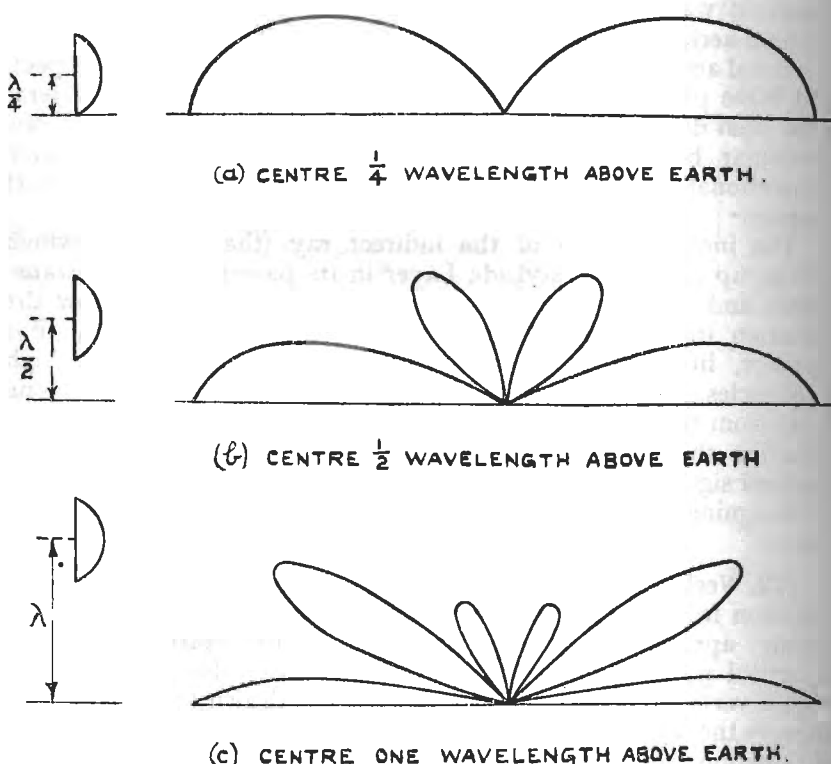
772. Vertical Polar Diagrams.—The relative intensity of the radiation from an aerial at various angles to the horizontal is most readily appreciated from a graphical representation. Such a "vertical polar diagram" is shown in Fig. 457 for the radiation from a vertical aerial. The length of a line drawn from O at any angle to the horizontal to meet the curve is a measure of the amount of radiation (actually of the electric field strength) at that angle.

The shape of the curve depends on the conductivity at the earth's surface. The full-line curve assumes a perfectly conducting earth. The effect at high frequencies of the earth's imperfect



Vertical Aerial.

FIG. 457.



Vertical Half Wavelength Aerial.

FIG. 458.

conductivity is shown by the dotted line polar diagram. This explains, incidentally, the well-known effect that short wave reception improves considerably as the receiver is taken up a hill with a downward slope towards the transmitter.

The vertical polar diagrams for a vertical half wavelength aerial, whose centre is at various heights above the earth's surface, are shown in Fig. 458.

It will be seen that the effect of raising the aerial is to concentrate the upward radiated energy into " beams " at definite angles, and that these beams increase in number and become narrower as the height of the aerial above the ground is increased.