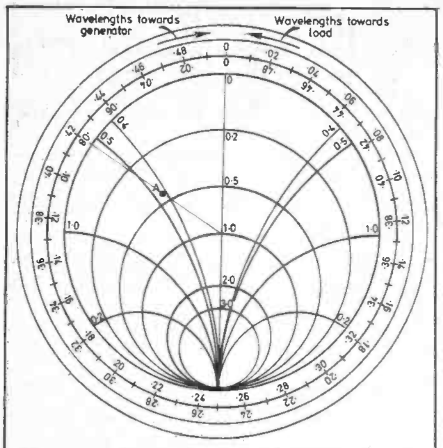

Fig. 10A Plot the start point.

tive reactance caused by the short circuit termination on the gamma "transmission line". This can be calculated as: $X_p = j.\ \tan\theta$, or $B_p = -j/\tan\theta$

Alternatively, we can use the Smith Chart to find the value. Using the outer scale, wavelengths towards generator, the impedance due to a short circuit *at* that short circuit is 0+j0. Travel towards the generator down a transmission line a distance 0.08245γ, put in the line from the centre to this point C, and you will see the reactive impedance is 0.57 ohms. We know θ is 29°41′, and tan θ is approximately 0.57 ohms (**Fig. 10C**).

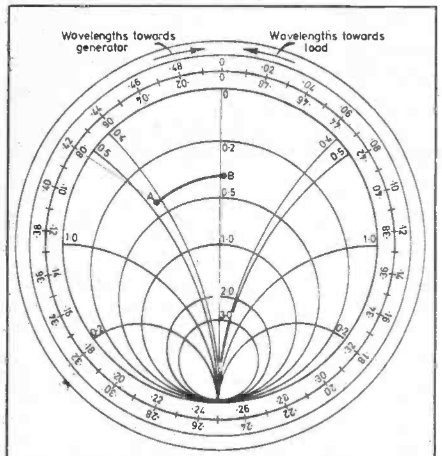

Fig. 10B Rotate through 0.08245 wavelength.

These two impedances are in parallel, so they have to be added as admittances. In the previous example of a matching network I used an overlay system, as recommended by Phillip Smith. Here is a new trick to convert impedances and admittances.

Draw a straight line through point B as a diameter. Use compasses to draw an arc centred on 1.0 through B to cut the diameter on the far side of 1.0. This is point D (2.85 − j0.005), **Fig. 10D**. Check it using a calculator and the formulae $G = R/(R^2 + X^2)$; $B = X/(R^2 + X^2)$. You will find that point D is the normalised admittance equivalent to the impedance of point B. What a way to ease the design of matching networks given earlier! Similarly convert point C to point C′. The susceptance equivalent to a reactance of 0.57 is −1.75.

To show the composite effect of the admittance due to the aerial at the feedpoint and the susceptance due to the short circuit, we now have to travel

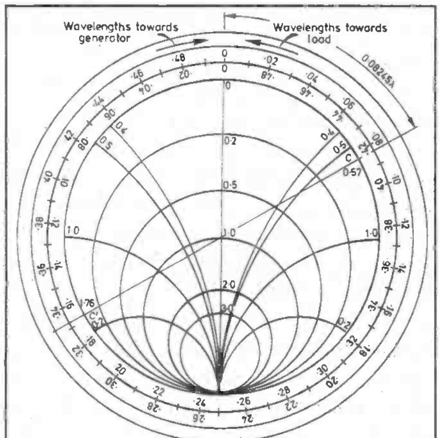

Fig. 10C Find effect of S/C.

anticlockwise on the circle of constant conductance from point D a distance of 1.75 mho to point E. This is effectively adding the two values D and C′. Anticlockwise because C′ is a negative value. this value E is 2.85 − j1.76, and is the input admittance of the complete aerial at the feedpoint. (**Fig. 10E**)

We invert again using straight edge and compasses as before and get the equivalent input impedance at point F (0.254 + j0.157). **Fig. 10F**. This value is normalised to

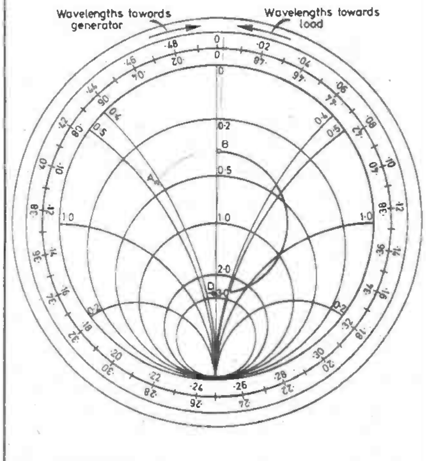

Fig. 10D Convert to admittance.

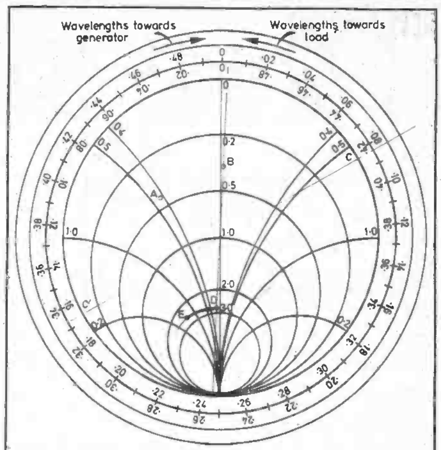

Fig. 10E Add the admittances.

200 ohms, so in real terms this is 50.8 + j031.36 ohms. Hence the aerial has an input impedance of 50.8 ohms and requires a series capacitor of reactance 31.36 ohms to tune it correctly.

The Smith Chart can be used for waveguide calculations, transmission and standing wave losses, lumped values such as those of striplines, and negative impedances as well as the comparatively simple analyses I have shown here. This article is merely an invitation for you to get your feet wet, and maybe you will be able now to follow other articles on the Smith Chart. It is a really

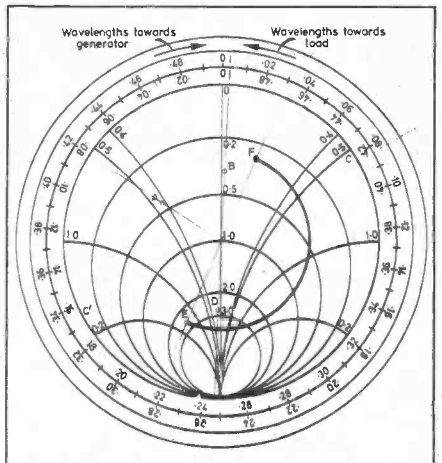

Fig. 10F Convert back to impedances.

powerful tool to aid circuit design.

For those of you who want to translate the numbers above into a practical design of a gamma match 2m dipole, here are the details.

The main element is a 1m length of ¾in diameter aluminium tubing. This is available from DIY suppliers as wardrobe railing. Where I bought it, it costs £4.65 for a 4m length. The gamma match is made from a 6in length of old TV aerial rod, one end being crimped