Fig. 11.23 If $z_{in} = 2.5 + j0$ on a line 0.3 wavelengths long, then $z_L = 2.1 + j0.8$.

wavelength, a minimum is 21.0 cm from the load. The voltage *maximum* is thus $21.0 - (37.5/2) = 2.25$ cm from the load, or $2.25/75 = 0.030$ wavelength from the load.

With this information, we can now turn to the Smith chart. At a voltage maximum the input impedance is a pure resistance equal to sR_0; on a normalized basis, $z_{in} = 2.5$. We therefore enter the chart at $z_{in} = 2.5$ and read 0.250 on the wtg scale. Subtracting 0.030 wavelength to reach the load, we find that the intersection of the $s = 2.5$ (or $|\Gamma| = 0.429$) circle and the radial line to 0.220 wavelength is at $z_L = 2.1 + j0.8$. The construction is sketched on the Smith chart of Figure 11.23. Thus $Z_L = 105 + j40\,\Omega$, a value which assumes its location at a scale reading of -11.5 cm, or an integral number of half-wavelengths from that position. Of course, we may select the "location" of our load at will by placing the short circuit at that point which we wish to consider the load location. Since load locations are not well defined, it is important to specify the point (or plane) at which the load impedance is determined.

As a final example, let us try to match this load to the 50 Ω line by placing a short-circuited stub of length d_1 a distance d from the load (see Figure 11.24). The stub line has the same characteristic impedance as the main line. The lengths d and d_1 are to be determined.
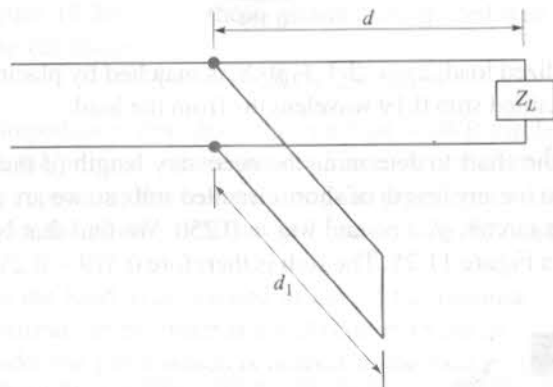

Fig. 11.24 A short-circuited stub of length d_1, located at a distance d from a load Z_L, is used to provide a matched load to the left of the stub.

The input impedance to the stub is a pure reactance; when combined in parallel with the input impedance of the length d containing the load, the resultant input impedance must be $1 + j0$.