in fact it is remarkable that it is possible at all. Unfortunately in order to have asymptotic freedom one is forced to large gauge groups and representations. Furthermore we have not been able to find any examples of models in which the gauge symmetry is completely broken. For these reasons the results presented below reinforce our expectation that if asymptotically free theories of the strong interactions are to be sensible then the symmetry breaking must be dynamical.

Let us now analyze the renormalization group equations for gauge theories involving scalar mesons. First we note that the scalars have essentially the same effect on $\bar{g}$ as the fermions. In the vicinity of the origin in coupling constant space, the renormalization group equation for the gauge coupling $\bar{g}$ does not involve the scalar self couplings. These would contribute terms to Eq. 4.8 of order $\bar{g}^2\bar{\lambda}^2$, where λ is some scalar self coupling. However unless $\lambda \leqq O(g^2)$ then the scalar self couplings are not asymptotically free (see below) and thus these corrections are negligible. The net effect of the scalars is to contribute to $\beta(g)$ a term equal to $\frac{1}{8}(\frac{1}{4})$ of the fermion contribution if the scalars transform according to a real (complex) representation of the gauge group. Thus

$$\beta(g) = -\frac{g^3}{16\pi^2}\left[\frac{11}{3}C_2(G) - \sum_{\text{FERMIONS}} \frac{4}{3}\frac{C_2(R)d(R)}{r} - \sum_{\text{SCALARS}} \frac{1}{6}\frac{C_2(R)d(R)}{r}\right] = -\frac{b_o}{2}g^3 + \ldots \tag{6.2}$$