1014-52-1114 **Wlodzimierz Kuperberg*** (`kuperwl@auburn.edu`), Department of Mathematics and Statistics, Auburn University, Auburn, AL 36849-5310. *Optimal configurations of k congruent balls packed in a sphere in $\mathbb{R}^n$ $(k \leq 2n)$.*

The minimum radius of a spherical container in $\mathbb{R}^n$ that can hold k unit balls $(k \leq 2n)$ has been found by R.A. Rankin in 1955. For $k \leq n+1$ the configuration of the balls is unique, their centers forming the set of vertices of a $(k-1)$-dimensional regular simplex. For $k = 2n$, the configuration is unique as well, the balls' centers forming the set of vertices of a regular n-dimensional crosspolytope. But uniqueness does not hold in any of the remaining cases, $k = n+2, n+3, \ldots, 2n-1$. Here we present an alternate proof of Rankin's result for $n+2 \leq k \leq 2n$ that strengthens it by including a description of all of the non-unique optimal configurations, some of which exhibit traces of regularity. Also, we prove that the configuration space $\mathcal{C}_n(k)$ is connected, for every $k \leq 2n$. (Received September 27, 2005)