We will present a preconditioned LSQR algorithm for solving large sparse least squares problems $\min_x \|Ax - b\|_2$. Our method calculates the preconditioner using a restarted Lanczos bidiagonalization method, then applies the preconditioner to the LSQR algorithm. This preconditioner can be calculated efficiently using a small storage space for the Lanczos bidiagonalization method. The restarting is carried out by augmenting the Krylov subspaces that arise naturally in the Lanczos bidiagonalization method, with the Harmonic Ritz vector approximations to the singular vectors associated with the smallest singular values. Numerical examples show this method to be competitive with existing methods. (Received September 19, 2011)