Computed tomography using proton and alpha particle beams has been previously investigated using fan beam geometry and total residual energy measurements of single particle events. Fourier transform CT reconstruction was used in those investigations. We have constructed and characterized the performance of a proton CT system which utilizes cone beam geometry and an energy modulation system that is capable of acquiring a 16 x 16 x 16 cm data set with approximately 512^3 voxel resolution in a few minutes. The system consists of a phosphor screen (GdOS:Tb) viewed by a scientific grade CCD camera. The CCD signal versus penetration depth of the proton beam is made nearly linear with the use of a beam energy modulator designed for the purpose. Images obtained of a contrast and spatial resolution phantom have been used to perform a Feldkamp-Davis -Kress cone beam reconstruction. The resulting data show spatial resolution limits due to proton multiple coulomb scattering of about 4 lp/cm. This system suggests a practical method for *in vivo* proton stopping power measurement. The CT reconstructed proton stopping powers of known materials show that the traditional method of converting xray CT Hounsfield units to proton stopping power may lead to errors in proton therapy treatments.