The principal aim of this Thesis was the investigation of quantum turbulence in superfluid helium in a special type of flow, spherically symmetric thermal counterflow. To this end, a new cell was designed and 3D-printed. Measurements of quantum turbulence were realized using the traditional technique of second sound attenuation, focusing both on steady state of turbulence and its temporal decay. The measured dependence of the quantized vortex line density L versus the counterflow velocity v_{ns}, where the data clearly show that $L \propto v_{ns}^{3/2}$, does not agree with the Vinen equation, which predicts $L \propto v_{ns}^{2}$. On the other hand, the dependence of vortex line density on time t obtained during the decay measurements $L \propto t^{-1}$ is paradoxically in close agreement with the Vinen equation. For the future, spherically symmetrical thermal counterflow thus promises many interesting challenges and will remain an important topic of research.