We consider hypersurfaces with boundary which evolve in the direction of the unit normal with speed equal to the reciprocal of the mean curvature. The boundary condition is of Neumann type, i.e. the evolving hypersurface moves along but stays perpendicular to a fixed supporting hypersurface.

In the case where the supporting hypersurface is a convex cone we prove long-time existence for star-shaped initial hypersurfaces of strictly positive mean curvature.

In the general case, however, one can not expect the flow to exist for all time. Therefore, we use a level-set approach together with a variational formulation to prove the existence of weak solutions. Furthermore, we indicate the existence of a monotone quantity which is the analog of the Hawking mass for closed hypersurfaces.