Quasi-similar solutions for blast waves with internal heat transfer effects

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The point explosion problem with internal heat transfer effects taken into account is analysed. The classical inviscid solutions to this problem yield a non-physical phenomenon of infinite temperature and zero density at the center of explosion for all times. With heat transfer fluxes considered, the solution near the center of symmetry is improved and finite values for temperature are obtained. The non-self-similar solution of the problem is based on the quasi-similar approximate technique which reduces the non-linear partial differential equations governing the problem to ordinary differential ones. However, this formulation yields a two-point boundary-value problem. To facilitate the integration, the flow field is first divided into two regions: an outer inviscid region and an inner region where dissipation effects are manifested. This results in two sets of ordinary differential equations expressing the conservation equations in the inner and outer regions which are then solved and matched together to yield the composite solution. Secondly, the problem is then transformed into an initial-value one. Using the results of the composite solution, the governing equations can be integrated directly from the center until the shock front. The structure of the non-self-similar flow fields with internal heat transfer effects is then fully determined for specified values of the heat transfer parameters.

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