Arthur Thompson Johnson

axt4093@rit.edu

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WEAR RESISTANT FUSED FILAMENT EXTRUSION HEAD

Aspects of devices in which plastic is extruded for a three dimensional printer. Novel designs for components of a high performance fused filament extrusion head are disclosed within, a novel “heat-break” and wear resistant “feed tube”. The feed tube serves as a path for filament as it is fed from the cold end into the hot end. The heat-break rigidly connects the cold end to the hot end while providing resistance to the flow of heat.

A novel “heat-break” or bridge rigidly connects a “cold block” and “hot-end” *(Figure 2),* deflecting minimally under the forces of high acceleration movements; provides resistance to the flow of heat during extrusion of various high temperature plastics.

A carbide “feed tube” *(Figure 2)*, contains the flow of filament from the entrance of the cold block to the face of a removable nozzle. The carbide is wear resistant to the flow of filled plastic and is silver-brazed into the hot-end side of the structure, decreasing thermal resistance and reducing overall size and weight. The feed tube is coupled to the cold block side of the device with a slip fit cylindrical hole; thermal resistance is decreased by coupling the cold block to feed tube with high temperature thermal compounds such as boron nitride.

The carbide feed tube is particularly suitable for fused filament fabrication due to its very high thermal conductivity and long term wear resistance. However, the following steps must be taken to ensure the success of using a carbide feed tube: (1) A water cooler is employed in order to keep the plastic’s temperature low enough up to the entrance of the ‘hot-end.’ (2) Carbide is a particularly brittle material. Therefore, the feed tube must not be a structural member of the device.

The novel heat-break disclosed here solves problems of carbide brittleness and heat transfer. Flat sheet metal parts span the distance between cold-end and hot-end, ensuring minimal load on the feed tube. The sheet metal parts, individually flexible, are combined to create a stiff structure. During assembly these parts are put under no bending or axial stresses and inversely, put no axial or bending stresses on the feed tube. This design aspect permits quick, low cost, manufacturing of the heat-break components; poor tolerances are mitigated. Being thin they possess a small cross section and additionally can be constructed of low thermal conductivity materials such as titanium or stainless steel. Conducting minimal heat, they both increase efficiency and decrease load on the water cooler.

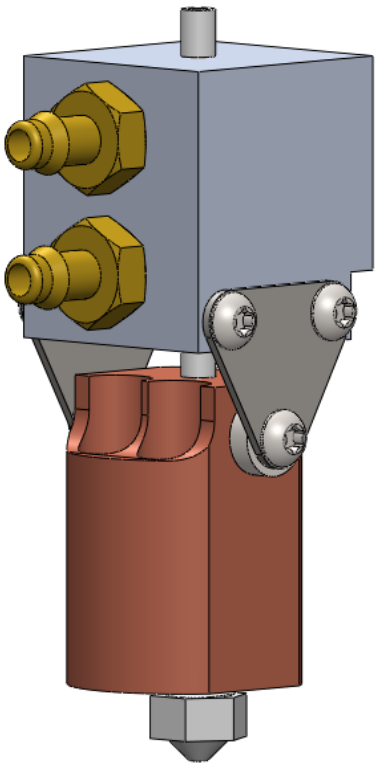

Figure 1 : Complete device

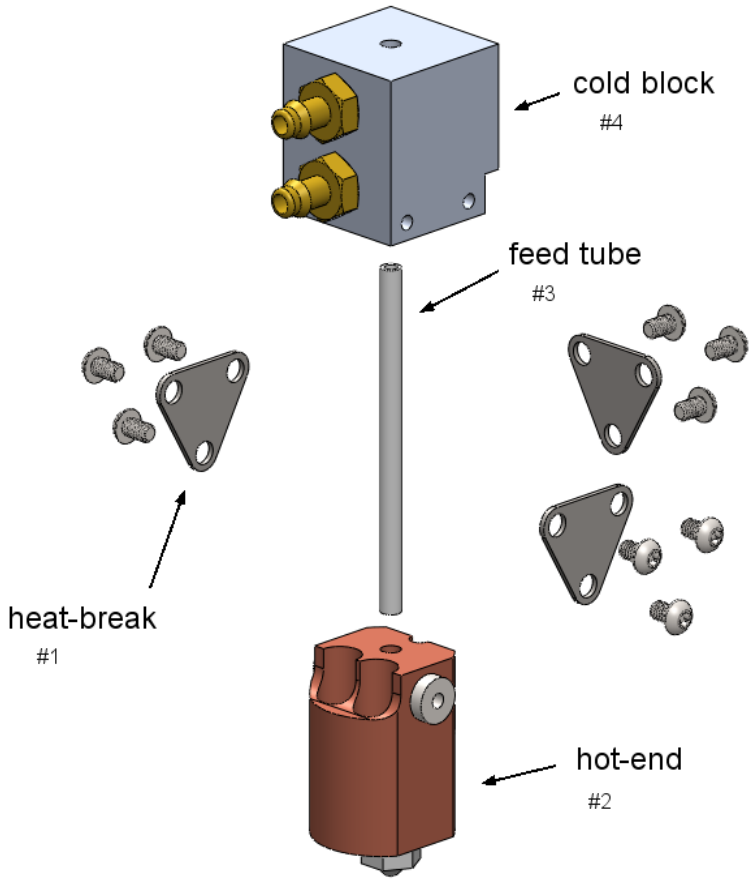

Figure 2 : Exploded view