[0058] The first mold die **210** has a first face **212** that includes a substantially planar surface. The first face **212** has a recessed section **214** formed therein. The recessed section **214** generally defines the outer peripheral shape of the microfluidic device and also the depth of the recessed section **214** defines the thickness of the microfluidic device (except in areas where the nozzles are formed). Because the microfluidic device typically has a square or rectangular shape, the shape of the recessed section **214** will be the same or similar. For example, the illustrated recessed section **214** is generally square shaped. The first mold die **210** also includes a plurality of upstanding contoured pins **216** that are spaced across a floor of the recessed section **214**. The shape of each pin **216** directly corresponds to the shape of the microfluidic channel that will be formed when the mold **200** is closed and the polymeric material is injected. More specifically, a base section **217** of the pin **216** corresponds to the reservoir of the microfluidic channel; an intermediate section **218** corresponds to the intermediate section of the microfluidic channel and a conical tip section **219** of the pin **216** corresponds to the second end of the microfluidic channel that is formed in the tip portion of the nozzle. As a result, the dimensions of the pin **216** are greatest at the base section **217** and the pin **216** tapers inwardly to the conical tip section **219** thereof. The spacing of the pins **216** directly correlates to the spacing of the microfluidic channel/nozzle structure and therefore, the pins **216** are preferably spaced in arrays.

[0059] Now referring to FIGS. **6-7**, the second mold die **230** has a first face **232** that mates with the first face **212** of the first mold die **210**. The first face **232** is substantially planar with the exception that a plurality of apertures **234** are formed in the second mold die **230**. The apertures **234** are arranged according to a predetermined pattern that corresponds to the arrangement of the pins **216**. The apertures **234** are sized so that they receive at least a portion of the conical tip sections **219** (about 500 μm in length in one embodiment) of the pins **216** when the first and second mold dies **210, 230** mate with one another. The apertures **234** are themselves contoured so that the apertures **234** taper inwardly with a lower portion **235** of each aperture **234** having a conical shape so as to form the conical nozzle of the microfluidic device. When the first and second molds **210, 230** mate together and the pins **216** are received in the apertures **234** according to one embodiment, the tip sections **219** of the pins **216** extend completely to the bottom of the apertures **234** and contact the body of the second die mold **210** that defines the closed ends of the apertures **234**. The mold **200** of **FIG. 6** is constructed to generally produce the microfluidic device **10** of **FIG. 1**.

[0060] **FIG. 7** shows a cross-sectional view of a mold that is constructed to produce the microfluidic device **100** of **FIG. 4**. For purposes of ease of illustration and simplification, the reference numbers of **FIG. 6** will be carried over to the description of FIGS. **7-9** since each of these illustrated molds includes first and second mold dies. It will be understood that the features that are formed as part of the first and second mold dies **210, 230** dictate the dimensions and shape of the features of the resulting microfluidic device.

[0061] It will therefore be appreciated that after the first and second mold dies **210, 230** are closed and any preparation steps that are necessary for the injection molding process are taken, the first faces of the first mold die **210** and the second mold die **220** seat against one another to effectively seal the recessed section **214** and the polymeric material (typically a resin) is then injected into the closed space that is defined in part by the recessed section **234**. **FIG. 7** shows a cross-sectional view of the first and second mold dies **210, 230** in a closed position with the tip section **219** of one pin **216** received within the aperture **234** and more specifically into the conically shaped lower portion **235** of the aperture **234**. Because the first and second mold dies **210, 230** are negative impressions of the resultant microfluidic device, the microfluidic channel will take the form of the pin **216** and the nozzle of the microfluidic device is formed by the conically shaped lower portion **235**. More precisely, the nozzle is formed by resin filling completely the space between the tip section **219** of pin **216** and the tip section of the conically shaped lower portion **235**. As previously mentioned, in this embodiment, the tip section **219** of the pin **216** and the tip of the second mold die **230** that is formed in the conically lower shaped portion **235** are in contact with one another.

[0062] Mold **200** is intended to be used a number of times over a period of time to produce a great number of microfluidic devices and therefore the material that is selected for the fabrication of the mold **200** should be done so accordingly. In other words, a material should be selected that permits microscale features to be formed in the microfluidic device and also permits a great number of microfluidic devices to be formed using the mold **200**. One material that is suitable for use in fabricating the mold **200** is hardened steel. With conventional machining technologies, such as metal turning and electric discharge machining (EDM), the dimensions of the tip section **219** of the pin **216**, which forms the nozzle opening, can be limited. For example, the dimensions (i.e., the diameter and length) of the tip section **219** can be limited due to manufacturing considerations. The available manufacturing techniques permit the outside diameter of the nozzle to be formed to about 50 μm since it is possible to inject mold a resin into the space between the tip section **219** and the conically lower shaped portion **235**. In some areas, this space is only on the order of about 15 μm due to the desired dimensions of the nozzle and the microfluidic channel.

[0063] While, the first mold die **210** is illustrated as having a square shape, it will be appreciated that the first mold die **210** can be formed to have any number of different shapes so long as the shapes of the first mold die **210** and the second mold die **230** permit these two components to mate with one another.

[0064] However, there are techniques available to injection mold a nozzle opening having smaller dimensions than the aforementioned dimensions. **FIG. 8** illustrates one possible injection molding arrangement to accomplish this task and produce nozzles having nozzle openings that are even smaller than the tip section **219** of the pin **216**. In **FIG. 8**, there is a gap **240** between the tip section **219** and the conically shaped lower portion **235** after the first and second mold dies **210, 230** have been assembled. When the polymeric material (e.g., a resin) is injected (in a molten state) into the conically shaped lower portion **235**, the pressure of the injected resin is adjusted such that the resin does not fill the entire space in the gap **240** and an opening (space) remains at the tip of the resulting molded nozzle since sufficient pressure is not present to displace the resin to the