[0063] Upon actuating heat source **37'**, the temperature of TRS **57'** in reservoir **55'** is preferably not raised by an amount sufficient to disperse or melt TRS **57'**. Thus, substantially all of TRS **57'** remains essentially stationary in reservoir **55'** so that access port **40** is not brought into fluid communication with passage **68'**. The lower temperature of TRS **57'** can be maintained by limiting the duration of heat applied to TRS **56'** and by increasing the distance of access port **40** from passage **68**.

[0064] Referring to **FIG. 5***a,* a valve **150** having two downstream abutting portions is shown in a closed state. When valve **150** is closed, a mass of temperature responsive material **156** obstructs material transport through a passage **168** between first and second channels **152, 154**. A first abutting portion **170** of TRS **156** abuts a wall **172** of closed valve **150**. Wall **172** includes a first opposed wall portion **174**, which is disposed at an angle to central axis **160** and material transport path **158**. Thermally responsive substance **156** includes a second abutting portion **176** disposed to abut first opposed wall portion **174** when valve **150** is closed. A third abutting portion **200** of TRS **156** abuts an opposed wall portion **202** of valve **150**. Opposed wall portion **202** is disposed on an opposite side of central axis **161** from opposed wall portion **174**, preferably adjacent a reservoir of TRS **155**.

[0065] Abutting portions **176, 200** and wall surfaces **174, 202** are configured and disposed to prevent undesirable leakage through valve **150** when the pressure acting upon an upstream portion **181** of TRS **156** exceeds the pressure acting upon a downstream portion **178**. The excess upstream pressure preferably urges abutting portions **176** and **200** against opposed wall portions **174** and **202**, respectively, thereby closing valve **150** more securely. The presence of two downstream opposed walls decreases the tendency of TRS **56** to distort in response to upstream pressure.

[0066] First opposed wall surface **174** is preferably integral with a first wall projection **180** that extends into a material transport path **156** of first channel **52**. Projection **180** includes a second opposed wall portion **186** and an outer wall surface **188**. Opposed wall portion **202** is integral with a second wall projection **204** that also extends into material transport path **156**. Projection **204** includes a second opposed wall portion **206** and an outer wall portion **208**.

[0067] A distance **182** between outer wall portions **188**, and **90** is preferably smaller than a corresponding distance **184** between opposed walls of first channel **152** at a point **162** upstream from valve **150**. Distance **182** is at least 10% smaller, preferably at least 20% smaller, and more preferably at least 30% smaller than upstream distance **184**. Thus, opposed wall portions **174, 202** or projections **180, 204** define a restriction therebetween. The restriction has a smaller cross sectional area than a cross sectional area at upstream point **162**. Although projections **180** and **204** are shown as generally rectangular, projections having other shapes such as triangular or shapes with arcuate surfaces can be used.

[0068] Referring to **FIG. 5***b,* an open state of valve **150** is shown in which TRS **156** has been essentially fully retracted into reservoir **155** to open passage **168**, thereby permitting passage of material through valve **150** from at least one of the first and second channels to the other. In the fully open state, an opening distance **192** from abutting TRS portion **170** to wall **172** is preferably at least as great distance **182** of second channel **54**. It should be understood, however, that valve **50** can be operated in a partially open state, in which opening distance **192** is less than distance **182**. As discussed for valve **50** above, an open state of valve **150** can be repositioned repeatedly between the opened and closed states without a significant loss of material **156** or capacity to prevent transport of material when closed.

[0069] A valve **150'**, seen in **FIGS. 6***a* and **6***b* operates similarly to valve **150** in the closed state. In opening passage **68**, valve **150'** operates similarly to valve **50'** in that a mass of TRS **156'** obstructing passage **68** disperses or melts, thereby opening passage **68**. The dispersal or melting preferably occurs upon actuation of a heat source **37** in thermal contact with TRS **156'**.

[0070] Referring to **FIG. 7***a,* a valve **250** includes a projection **280** having first and second opposed wall portions **274, 286** that cooperate to prevent leakage in response to both upstream and downstream pressure. In the closed state, a mass of temperature responsive material **256** obstructs a valve passage **268**, thereby at least substantially preventing the transport of material in either direction between a first channel **252** and a second channel **254**. Projection **280** is preferably centered relative to a dimension **287** of TRS **256** that is substantially aligned with a material transport path **258**. Although projection **280** is shown as being substantially square, a projection having any shape, such as rectangular, triangular, or arcuate can be used.

[0071] A first abutting portion **276** of TRS **256** abuts first opposed wall portion **274** and a second abutting portion **277** of TRS **256** abuts second opposed wall portion **286**. First and second abutting portions **276**, and respective opposed wall portions **274, 286** substantially prevent passage of material through valve **50** when excess pressure is applied to either a first side **276** or a second side **278** of TRS **256**. For example, excess upstream pressure acting upon second side **278** urges second abutting portion **277** against opposed wall portion **286**, thereby closing valve **250** more securely. Valve **250** responds similarly when excess upstream pressure acts upon first side **281**. Thus, valve **250** operates as a two-way valve to prevent leakage in response to excess pressure from either of two flow directions. To more securely close valve **250**, at least a third abutting portion **274** abuts a valve wall **270**, which is preferably substantially aligned with a central axis **260** of first channel **252**.

[0072] In one embodiment of the present invention, a length of the thermally responsive substance that is aligned with a material transport path is greater than at least one of a width of the passage obstructed by the thermally responsive substance and a width of an upstream channel. As used herein, the term length refers to a distance along a material transport path, which is preferably aligned with a central axis of a channel or passage. The term width refers to the larger dimension of a channel or passage that is opposed to a material transport path or central axis therethrough. Referring to **FIG. 7***a,* for example, a dimension or length **287** of TRS **256** is greater than a width **289** of passage **268** and a width **284** of first channel **252**. A dimension or width **291** of reservoir **255** is preferably at least as large as length **287**. Dimension **287** of TRS **256** is at least 15%, preferably at least 25%, and more preferably at least 30% greater than width **284** of first channel **252**.