square inch (psig). For the catalyst withdrawal valve service, the valve is connected to the bottom of the regenerator, which pressure can be as high as 45 pounds per square inch gage (psig) or more, and the pressure on a downstream side of the valve where there is a partial or full vacuum. The pressure drop across the catalyst withdrawal valve is very high for this type of valve to survive. Normal operation of a slide valve is usually kept at less than 12 pounds per square inch differential pressure or less during flow operation, and very seldom does operation occur with the valve at a 15 to 20 pounds per square inch pressure differential. A slide valve used as a catalyst withdrawal valve may see as much as 40 or 45 pounds per square inch pressure drop across the valve.

[0010] An additional problem that may be encountered by a catalyst withdrawal valve occurs when there is a two-way flow through the valve. In such an operation, catalyst is first loaded into the regenerator at the startup of the process through the catalyst withdrawal valve, such that the flow of catalyst occurs in the opposite direction of what is considered normal flow. In such an operation the internal components of the valve need to be designed for flow of catalyst in both directions with respect to the valve, and with erosion or wear protection provided to the components of the valve for both directions of flow.

[0011] A further problem encountered with prior slide valves is that the valve actuating stem, which moves the valve disc between open and closed positions, tended to bend when a force was applied by the actuating stem to the valve disc to move the valve disc into the closed position. The bending of the actuating stem caused premature failure of the packings in the actuating stem stuffing box, and was not controllable at the end of stroke position. In addition, the disc would sometimes hit a mechanical stop at the end of the closing stroke of the valve disc before the valve disc reached its fully closed position due to interference with catalyst buildup inside the valve.

SUMMARY

[0011a] According to a first aspect of the present invention, there is provided a slide gate valve for controlling the flow of gas, liquid and catalyst material in a fluid catalytic cracking process comprising:

a valve body having an internal chamber and formed to include an inlet, and an outlet;

an orifice plate positioned within the chamber, the orifice plate formed to include an orifice;

first and second disc guides that are located on opposite sides of the orifice, the disc guides each include a guide channel and a wedge having a wedge surface;

a valve disc positioned between the first and second disc guides and configured to slide along the disc guides from a fully opened position in which gases, liquids and catalyst materials can pass through the orifice to a fully closed position in which the orifice is blocked, preventing the flow of gases, liquids or catalyst materials through the orifice, the valve disc including a pair of wedges each having a wedge surface;

wherein movement of the valve disc from the fully opened position toward the fully closed position causes the valve disc to slide linearly along the first and second disc guides until a point in the travel of the valve disc where the wedges of the valve disc engage the wedges of the first and second disc guides to cause translational movement of the valve disc toward the orifice plate to seal the valve disc against the orifice plate to block flow through the orifice.

[0011b] According to a second aspect of the present invention, there is provided a slide gate valve for controlling the flow of gas, liquid and catalyst material in a fluid catalytic cracking process comprising:

a valve body having an internal chamber and formed to include an inlet, and an outlet;

an orifice plate positioned within the chamber, the orifice plate formed to include an orifice;

first and second disc guides that are located on opposite sides of the orifice, the disc guides each include a guide channel and a wedge having a wedge surface;

a valve disc positioned between the first and second disc guides and configured to slide along the disc guides from a fully opened position in which gases, liquids and catalyst materials can pass through the orifice to a fully closed position in which the orifice is blocked, preventing the flow of gases, liquids or catalyst materials through the orifice, the valve disc including a pair of wedges each having a wedge surface;

an actuator stem having a first end coupled to the valve disc;

an actuator coupled to a second end of the actuator stem, wherein the actuator and the actuator stem are adapted to move the valve disc from the fully opened position to the fully closed position;

wherein movement of the valve disc from the fully opened position toward the fully closed position causes the valve disc to slide linearly along the first and second disc guides until a point in the travel of the valve disc where the wedges of the valve disc engage the wedges

of the first and second disc guides to cause translational movement of the valve disc toward the orifice plate to seal the valve disc against the orifice plate to block flow through the orifice.

[0011c] According to a third aspect of the present invention, there is provided a slide gate valve for controlling the flow of gas, liquid and catalyst material in a fluid catalytic cracking process comprising:

a valve body having an internal chamber and formed to include an inlet, and an outlet;

an orifice plate positioned within the chamber, the orifice plate formed to include an orifice;

a disc guide positioned proximate the orifice and having a guide channel;

a valve disc configured to slide along the guide channel of the disc guide from a fully opened position in which gases, liquids and catalyst materials can pass through the orifice to a fully closed position in which the orifice is blocked, preventing the flow of gases, liquids or catalyst materials through the orifice;

a cam located in the internal chamber of the valve body;

wherein movement of the valve disc from the fully opened position toward the fully closed position causes the valve disc to slide linearly along the guide channel of disc guide until a point in the travel of the valve disc where the cam causes translational movement of the valve disc toward the orifice plate to seal the valve disc against the orifice plate to block flow through the orifice.

[0012] According to the present disclosure, a slide valve includes a valve disc and a disc receptacle. The disc receptacle includes disc guides and an orifice plate including an orifice, the disc valve being selectively slidable within the disc guides between a fully-retracted fully-open position that allows gas and particle flow through the orifice and a fully-extended fully-closed tight shutoff position that seals the orifice and prevents gas and particle flow through the orifice.

[0013] In illustrative embodiments, the valve disc and the disc receptacle include respective inclined wedges that engage each other to wedgingly press the valve disc into sealing