

designs that are suitable for use in subterranean operations are known in the art.

Although the apparatuses and structures described above can be desirably used for regulating the flow of fluids within a wellbore, there can be certain problems encountered when doing so. In the case of on/off or metering valves, significant quantities of undesired fluids can enter the wellbore pipe. If the production of undesired fluids becomes too great, this can sometimes necessitate closing the valve to shut off production from the subterranean zone in which the valve is located. In the case of apparatuses and structures that can discriminate between various types of formation fluids (e.g., autonomous inflow control devices), the design of the apparatuses and structures can be such that if they are exposed to particular types of formation fluids or particulate matter (e.g., sand), they can become plugged or abraided such that they no longer function as intended. Plugging of the apparatus or structure can result in incomplete production from a subterranean zone. Likewise, if the apparatus or structure becomes damaged in some way, it can sometimes permit greater access of undesired fluids to the interior of the wellbore pipe than is intended.

Although the exit port of an inflow control device can be intentionally blocked to shut off fluid flow from the device, this action most often has been performed with an added structure either within the wellbore pipe or disposed between the inflow control device and the exterior of the wellbore pipe. In either case, the accompanying volume reduction can prove detrimental for production rates. In addition, such downstream regulation of the inflow control device provides no mechanism by which the device can be protected from potentially damaging conditions.

SUMMARY OF THE INVENTION

Embodiments of the present invention generally relate to wellbore flow control devices and their use in producing a fluid from a subterranean formation, and, more specifically, to the coupling of flow regulating assemblies for improved control of fluid access to the interior of a wellbore pipe.

According to an aspect of the present invention, there is provided a wellbore flow control device comprising a gate valve assembly movably arranged within a housing coupled to a wellbore pipe and being in fluid flow communication with ~~one or more a~~ well screens via a first flow pathway extending upstream of the gate valve assembly; and a flow restricting assembly in fluid flow communication with the gate valve assembly via a second flow pathway,

wherein the flow restricting assembly is in fluid flow communication with the interior of the wellbore pipe. The gate valve assembly is movable between a first position, where a formation fluid in the first flow pathway is blocked from accessing the second flow pathway, a second position, where the formation fluid is able to pass through the gate valve assembly and enter the interior of the wellbore pipe via the second flow pathway; and is further movable to a third position, where the fluid in the first flow pathway is diverted away from the flow restricting assembly and directly into the interior of the wellbore pipe.

According to another aspect of the present invention, there is provided a method comprising arranging a wellbore pipe in an uncompleted wellbore, the wellbore pipe comprising at least one wellbore flow control device comprising a gate valve assembly arranged within a housing coupled to the wellbore pipe and being in fluid flow communication with ~~one or more~~ a well screens via a first flow pathway extending upstream of the gate valve assembly; and a flow restricting assembly in fluid flow communication with the gate valve assembly via a second flow pathway and the interior of the wellbore pipe. The method comprises moving the gate valve assembly from a first position, where a formation fluid in the first flow pathway is blocked from accessing the second flow pathway, to a second position, where the formation fluid is able to pass through the gate valve assembly and enter the interior of the wellbore pipe via the second flow pathway; and further moving the gate valve assembly to a third position, where the formation fluid in the first flow pathway is diverted away from the flow restricting assembly and directly into the interior of the wellbore pipe; and producing the formation fluid from the wellbore pipe.

In some embodiments, the present invention provides a wellbore flow control device comprising: a gate valve assembly that is in fluid flow communication with a flow restricting assembly, each assembly being located on

CLAIMS

1. A wellbore flow control device comprising:
 - a gate valve assembly movably arranged within a housing coupled to a wellbore pipe and being in fluid flow communication with ~~one or~~ more well screens via a first flow pathway extending upstream of the gate valve assembly; and
 - a flow restricting assembly in fluid flow communication with the gate valve assembly via a second flow pathway, wherein the flow restricting assembly is in fluid flow communication with the interior of the wellbore pipe,
 - wherein the gate valve assembly is movable between a first position, where a formation fluid in the first flow pathway is blocked from accessing the second flow pathway, a second position, where the formation fluid is able to pass through the gate valve assembly and enter the interior of the wellbore pipe via the second flow pathway; and
 - is further movable to a third position, where the fluid in the first flow pathway is diverted away from the flow restricting assembly and directly into the interior of the wellbore pipe.
2. The wellbore flow control device of claim 1, wherein the gate valve assembly comprises a sliding sleeve assembly.
3. The wellbore flow control device of claim 1 or 2, wherein the flow restricting assembly comprises a structure selected from the group consisting of an autonomous inflow control device, a non-autonomous inflow control device, tubing, a nozzle, a port, a tortuous path, and any combination thereof.
4. The wellbore flow control device of any one of claims 1 to 3, wherein the gate valve assembly is actuated to move either hydraulically or electrically.
5. The wellbore flow control device of any one of claims 1 to 4, wherein the gate valve assembly is actuated to move using a tool inserted from a surface into the wellbore pipe.

6. A method comprising:

arranging a wellbore pipe in an uncompleted wellbore, the wellbore pipe comprising:

at least one wellbore flow control device comprising a gate valve assembly arranged within a housing coupled to the wellbore pipe and being in fluid flow communication with ~~one or more~~ a well screens via a first flow pathway extending upstream of the gate valve assembly; and

a flow restricting assembly in fluid flow communication with the gate valve assembly via a second flow pathway and the interior of the wellbore pipe;

moving the gate valve assembly from a first position, where a formation fluid in the first flow pathway is blocked from accessing the second flow pathway, to a second position, where the formation fluid is able to pass through the gate valve assembly and enter the interior of the wellbore pipe via the second flow pathway; and

further moving the gate valve assembly to a third position, where the formation fluid in the first flow pathway is diverted away from the flow restricting assembly and directly into the interior of the wellbore pipe; and producing the formation fluid from the wellbore pipe.

7. The method of claim 6, further comprising:

moving the gate valve assembly back to the first position to isolate a subterranean zone.

8. The method of claim 6, further comprising injecting a fluid into a subterranean formation surrounding the wellbore using the wellbore flow control device when the gate valve assembly is in the second position.

9. The method of claim 6, further comprising injecting a fluid into a subterranean formation surrounding the wellbore using the wellbore flow control device when the gate valve assembly is in the third position.

10. The method of any of claims 6 to 9, wherein moving the gate valve assembly comprises actuating the gate valve assembly either hydraulically or electrically.

11. The method of any of claims 6 to 10, wherein moving the gate valve assembly comprises actuating the gate valve assembly with a tool inserted from a surface location into the wellbore pipe.