May 1, 1951 R. E. FERGUSON 2,550,984

VALVE

Filed Aug. 2, 1948

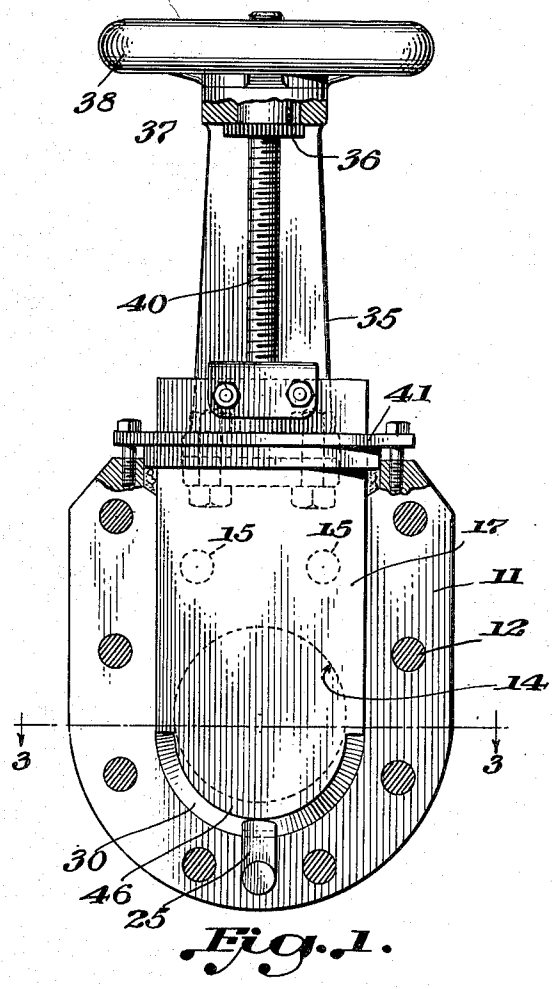


Fig. 1.

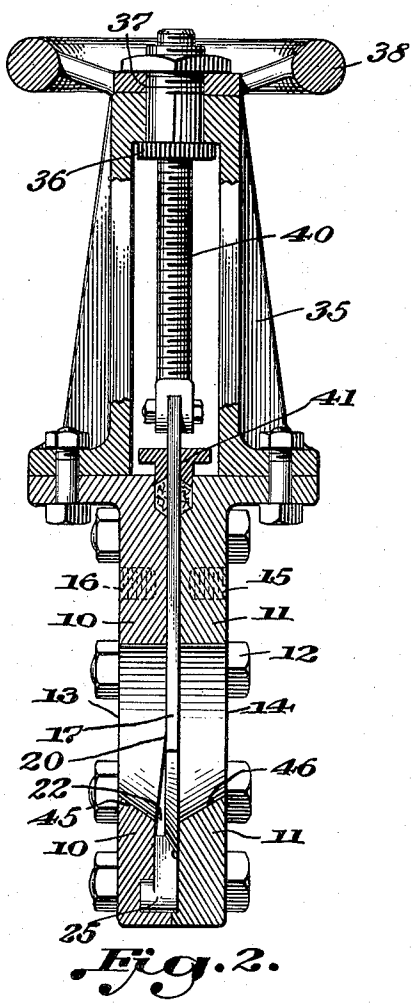


Fig. 2.

Fig. 4. Fig. 5.

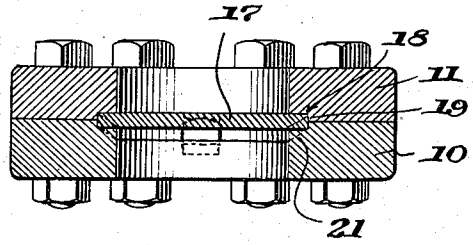
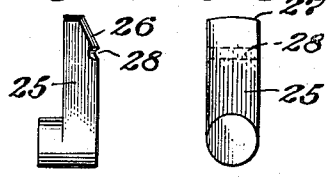


Fig. 3.



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VALVE

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8 Claims. (Cl. 251—56)

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The present invention relates generally to gate valves and more particularly to a gate valve especially adapted to control the flow of viscous liquids and/or other mixtures of solid or semi-solid bearing fluids such as pulp stock.

The gate valves used to control the flow of pulp stock in the paper industries have been the source of considerable trouble in the past in that they become inoperative or operative with difficulty because of the collection or lodging of the pulp stock from the fluid mixture on the valve surfaces exposed to the mixture. Pulp stock has a pronounced tendency to collect and harden in the valve casing, on the valve gate surfaces, in the valve gate guideways and in the valve gate seat, and such pulp deposits on the surfaces mentioned will resist the opening of the valve or prevent the valve from entirely closing and finally make the valve inoperative, thus requiring the valve to be disassembled and cleaned of the hard and glue-like tenacious masses thus accumulated in the valve body.

It is a principal object of this invention to provide a gate valve particularly adapted for use in controlling the flow of viscous liquids such as pulp stock and which will be self-cleaning to be easily operated at all times with an effective non-leaking sealing action.

Another important object of my invention is to provide a gate valve for controlling the flow of pulp stock and having a novel form of gate member adapted to cut through the pulp stock and cooperate with a novel form of valve inlet passageway to remove the collection of pulp stock in the valve gate guideway as the valve is closed.

It is a further object of this invention to provide a gate valve having a novel form of gate inlet passageway and cooperating gate and guideway surfaces such that the hardening of accumulated pulp stock around the gate edges is substantially prevented while the valve is closed and which will further enable the deposits of pulp stock on the gate surface to be readily removed as the gate is raised to open the valve.

Another object of the invention is to provide a gate valve having a novel form of gate guideway and inlet passageway such that the pressure of the pulp stock aids in the sealing of the gate and valve against leakage.

Another very important object of the invention is to provide a gate valve having a novel form of removable gate seating member which is shaped to minimize the deposit of stock in the vicinity of the gate seat when the valve is closed, the gate seating member being readily replaceable when worn to thus not require the replacement of a complete valve.

Further objects and advantages of the invention will be apparent with reference to the following specification and drawing, in which—

Figure 1 is a front view partly in section of the

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outlet half of the valve body or casing as seen from the inlet direction and with the valve gate seated in closed position against the removable valve seat member;

Figure 2 is a view partly in section taken on the vertical center line of the valve ports;

Figure 3 is a horizontal section on the line 3—3 of Figure 1;

Figure 4 is a side elevational detail view of the removable gate seating member; and

Figure 5 is a front elevational detail view of the gate seating member as it is seen from the inlet direction of the valve.

Referring to the drawings, the gate valve is comprised of a body member formed of the two complementary halves 10 and 11 which may be bolted together by a plurality of bolts 12. The valve body half member 10 is provided with an inlet passageway 13 and the half member 11 is provided with an outlet passageway 14. The configuration of the inlet and outlet passageways 13 and 14 will be referred to in more detail hereinafter. The valve body may be provided with pipe flange members by means of which the valve may be attached by threading, welding or any other suitable method to the pipe line containing the pulp stock whose flow is to be controlled. Such flange members are not shown in the drawing, but it will be understood that they may be of conventional design adapted to be fastened to the valve body by the bolts 12 together with a number of stud bolts (not shown) which may be threaded in the threaded recesses 15 and 16 on either of the valve body half members 10 or 11. Such arrangement enables the valve body to be connected in any pipe line where the space for the valve connection may be large or small.

The opposing face surfaces of the valve body half members 10 and 11 are provided with recessed guideway portions in which the gate member 17 is adapted to be slideably fitted. The recessed guideway portion in the outlet half 11 is provided with squared surfaces 18 and 19 around its entire periphery including the straight vertically extending side portions and the curved bottom portion corresponding to the outline of the gate member 17. The sides of the recessed portion of inlet half 10 are similarly squared along the straight side portions down to the point 20 shown on Figure 2, while the remaining bottom curved portion of the inlet half recess is deepened with a taper, as shown by the dotted lines 21 of Figure 3, to provide a space 22 between the inlet face edges of the gate member 17 and the lower inlet portion of the body half member 10.

Suitably shaped recesses are also provided in the valve body halves 10 and 11 to receive the removable tongue and valve seat member 25 as shown in Figures 1 and 2. The removable valve

seat member is shown in detail by Figures 4 and 5 of the drawing and is provided with a tapered and rounded gate seating surface 26 having a slightly rounded top edge 27. The tapered and rounded face surface 26 of the valve seat member 25 provides a substantially single line contact with the tapered knife edge 30 around the circular shaped lower half of the gate member 17 which is thus effective to prevent clogging and binding of the valve while still assuring complete sealing of the gate member against the recess walls of the outlet body half member 11.

A yoke member 35 is bolted to the valve body halves, as shown in Figure 2, and journals at its upper end a freely rotatable bushing 36 which is keyed at 37 to a handwheel 38. The bushing 36 is provided with an internally threaded bore through which is threaded a screw shaft 40. The screw shaft 40 is connected at its lower end to the upper end of the gate member 17 which passes into the valve body through a packing gland generally shown at 41. The packing gland may be of any suitable form containing a selected packing for the type of process stock or pulp to be controlled by the valve. It will be understood that the rotation of the handwheel 38 as described will be effective to raise or lower the gate 17, depending upon the direction of rotation of the handwheel, and thus open or close the valve.

Now, referring again in detail to the shape of the inlet and outlet passageways 13 and 14, it should be pointed out that the lower halves of both the inlet and outlet passageways are tapered as shown at 45 and 46 to enlarge that portion of the ports in the direction of the gate member to a size approximating the size of the gate. Specifically, the lower halves of the ports 13 and 14 are tapered from approximately the horizontal center line of each port to the bottom of each port to form an off-center or elliptical curve to the bottom of the ports, giving them a semi-conical shape. The tapered lower halves of the ports 13 and 14, together with their rounded upper halves, provide a straight line flow for the pulp stock with no corners or pockets in which pulp material can deposit. Furthermore, the tapered or inclined conical bottom portions of the ports, as described, provides space in which the liquid of the pulp stock tends to accumulate, so that when the valve is closed, the pulp stock around the gate bottom edges will remain moist and not harden to stick the valve. It should also be pointed out that the tapered shape around the bottom curve of the valve body inlet half also enables the full pressure of the pulp stock to be exerted against the edges of the gate member and thus firmly seat the gate member within the recess of the outlet half 11 and prevent leakage.

As previously described, the gate member 17 has, with the exception of its lower rounded end, sides with square edges which are adapted to fit snugly in the guideways formed by the recesses in the valve body half members 10 and 11. The leading lower circular edge of the gate 17 is beveled as shown at 30 and extends from a point just below the center line of the valve passageways when the valve is closed, as shown in Figure 1 of the drawing. Such configuration of the gate member provides a shearing action to clean the pulp stock from the gate guideways as the valve is closed and thus prevents any accumulation of stock which would tend to render ineffective the sealing of the valve or its operation. It will be noted that the space 22 which is provided by the deepening of the gate guideway recess in the inlet valve body half 10 is effective to receive pulp stock as it is sheared from the guideway edges when the gate is lowered to close the valve.

When the valve is closed, the gate 17 is seated against the removable tongue or valve seat member 25 as previously described, which is effective to force and seal the lower edges of the gate member against the corresponding guideway edge surfaces of the outlet half 11. A small semi-circular groove 28 having a degree of curvature approximating the degree of curvature of the bottom of the gate 17 may be provided in the tapered mating face surface 26 of the seat member 25 to prevent the sharp edge of the gate 17 from directly contacting the seating member and thus keep the gate member cutting edge sharp. When the valve seating member 25 becomes worn, it may be easily replaced by separating the two valve body halves 10 and 11 in the recesses of which it is fitted.

In one form of the gate valve of this invention which has been found particularly effective to control the flow of paper pulp stock, the tapered bottom portions 45 and 46 of the inlet and outlet ports 13 and 14, respectively, may be provided with a taper beginning at the horizontal center line of each port and amounting to one-sixteenth inch for each inch of valve diameter beginning with zero inch taper at the center line. Also, the tapered depth of guideway recess in the lower portion of the inlet body 10 providing the space 22 may be started at the horizontal center line of the port with a taper not to exceed one thirty-second of an inch for each inch of valve diameter and thus provide for the accumulation of stock mixture on the inlet face of the gate member 17 to aid in sealing the valve when the valve is closed. Also, in such preferred form of valve, the point at which the rounded and beveled cutting edge 30 of the gate 17 begins may be chosen as that point at a distance below the horizontal center line of the ports equal to one sixteenth of an inch for each inch of diameter of the valve when the valve is closed.

It should be understood that various portions of the valve may be made of selected materials most adapted to obtain the desired results. For example, it is preferable to construct the valve seating member 25 and the cutting edges 30 of the gate member 17 from hard metal.

I claim:

1. In a gate valve, a valve casing comprised of two complementary half members, one of said half members having an inlet port and the other of said half members having an outlet port, the opposing face surfaces of said half members being provided with recessed portions forming a gate guideway, a gate slidably positioned in said guideway and movable from a position interposed between said inlet and outlet ports, said gate having substantially straight side portions and a rounded bottom portion, the rounded bottom portion only of said gate having a beveled face opposite the inlet port thereby forming a knife edge adjacent the outlet port, and a removable gate seating member adapted to be fitted in suitable recesses in the bottom portions of the opposing face surfaces of the two half members, said gate seating member having a tapered and rounded seating surface, said surface being curved relative to the plane of the bevelled edge of the gate member to provide a single line gate seating contact with the beveled knife edge of said gate when said valve is closed.

2. In a gate valve, a valve casing comprised of two complementary half members, one of said half members having an inlet port and the other of said half members having an outlet port, the opposing face surfaces of said half members being provided with recessed portions forming a gate guideway, a gate slidably positioned in said guideway and movable from a position interposed between said inlet and outlet ports, said gate having substantially straight side portions and a rounded bottom portion, the lower part of the recessed portion in that half member having the inlet port being tapered so as to widen the recessed portion surrounding the bottom portion of the gate member, the rounded bottom only of said gate having a beveled face opposite the inlet port thereby forming a knife edge adjacent the outlet port of the valve, said space formed adjacent the bottom portion of the inlet port being positioned above and below the leading rounded edge of said gate when said gate is in closed position.

3. In a gate valve, a valve casing comprised of two complementary half members, one of said half members having an inlet port and the other of said half members having an outlet port, the opposing face surfaces of said half members being provided with recessed portions forming a gate guideway, a gate slidably positioned in said guideway and movable from a position interposed between said inlet and outlet ports, said gate having substantially straight side portions and a rounded bottom portion, the lower part of the recessed portion in that half member having the inlet port being shaped to provide a space adjacent the bottom portion of the gate member, the rounded bottom only of said gate having a beveled face opposite the inlet port thereby forming a knife edge adjacent the outlet port of the valve, said space formed adjacent the bottom portion of the inlet port being positioned above and below the leading rounded edge of said gate when said gate is in closed position, and a removable gate seating member adapted to be fitted in suitable recesses in the bottom portions of the opposing face surfaces of the two half members, said gate seating member having a tapered and curved surface, said surface being curved relative to the plane of the bevelled edge of the gate member to provide a single line gate seating contact with the beveled knife edge of said gate when said valve is closed.

4. In a gate valve, a valve casing comprised of two complementary half members, one of said half members having an inlet port and the other of said half members having an outlet port, the opposing face surfaces of said half members being provided with recessed portions forming a gate guideway, a gate slidably positioned in said guideway and movable from a position interposed between said inlet and outlet ports, said inlet and outlet ports having upper and lower portions, the lower port portions beneath the horizontal center line of said ports being tapered so as to widen the recessed portion surrounding the bottom portion of said gate member to provide an enlargement of the ports in the direction of the gate member, said gate having substantially straight side portions and a rounded bottom portion, the rounded bottom portion only of said gate having a beveled face opposite the inlet port thereby forming a knife edge adjacent the outlet port of the valve.

5. In a gate valve, a valve casing comprised of two complementary half members, one of said half members having an inlet port and the other of

said half members having an outlet port, the opposing face surfaces of said half members being provided with recessed portions forming a gate guideway, a gate slidably positioned in said guideway and movable from a position interposed between said inlet and outlet ports, said inlet and outlet ports having upper and lower portions, the lower port portions beneath the horizontal center line of said ports being tapered to provide an enlargement of the ports in the direction of the gate member, said gate having substantially straight side portions and a rounded bottom portion, the rounded bottom portion only of said gate having a beveled face opposite the inlet port thereby forming a knife edge adjacent the outlet port of the valve, and a removable gate seating member adapted to be fitted in suitable recesses in the bottom portions of the opposing face surfaces of the two half members, said gate seating member having a tapered and curved surface, said surface being curved relative to the plane of the bevelled edge of the gate member to provide a single line gate seating contact with the beveled knife edge of said gate when said valve is closed.

6. In a gate valve, a valve casing comprised of two complementary half members, one of said half members having an inlet port and the other of said half members having an outlet port, the opposing face surfaces of said half members being provided with recessed portions forming a gate guideway, a gate slidably positioned in said guideway and movable from a position interposed between said inlet and outlet ports, said inlet and outlet ports having upper and lower portions, the lower port portions beneath the horizontal center line of said ports being tapered to provide an enlargement of the ports in the direction of the gate member, said gate having substantially straight side portions and a rounded bottom portion, the lower part of the recessed portion in that half member having the inlet port being tapered so as to widen the recessed portion surrounding the bottom portion of said gate member, the rounded bottom portion only of said gate having a bevelled face opposite the inlet port thereby forming a knife edge adjacent the outlet port of the valve, said space formed adjacent the bottom portion of the inlet port being positioned above and below the leading rounded edge of said gate when said gate is in closed position.

7. In a gate valve, a valve casing comprised of two complementary half members, one of said half members having an inlet port and the other of said half members having an outlet port, the opposing face surfaces of said half members being provided with recessed portions forming a gate guideway, a gate slidably positioned in said guideway and movable from a position interposed between said inlet and outlet ports, said inlet and outlet ports having upper and lower portions, the lower port portions beneath the horizontal center line of said ports being tapered to provide an enlargement of the ports in the direction of the gate member, said gate having substantially straight side portions and a rounded bottom portion, the lower part of the recessed portion in that half member having the inlet port being shaped to provide a space adjacent the bottom portion of the gate member, the rounded bottom portion only of said gate having a beveled face opposite the inlet port thereby forming a knife edge adjacent the outlet port of the valve, said space formed adjacent the bottom portion of the inlet port being positioned above and below the leading rounded edge of said gate when said gate is in closed

position, and a removable gate seating member adapted to be fitted in suitable recesses in the bottom portions of the opposing face surfaces of the two half members, said gate seating member having a tapered and curved surface, said surface being curved relative to the plane of the bevelled edge of the gate member to provide a single line gate seating contact with the beveled knife edge of said gate when said valve is closed.

8. In a gate valve, a valve casing comprised of two complementary half members, one of said half members having an inlet port and the other of said half members having an outlet port, the opposing face surfaces of said half members being provided with recessed portions forming a gate guideway, a gate slidably positioned in said guideway and movable from a position interposed between said inlet and outlet ports, said gate having substantially straight side portions and a rounded bottom portion, the rounded bottom portion only of said gate having a beveled face opposite the inlet port thereby forming a knife edge adjacent the outlet port of the valve, a removable gate seating member adapted to be fitted in suitable recesses in the bottom portions of the opposing face surfaces of the two half members, said

gate seating member having a tapered and curved surface, said surface being curved relative to the plane of the bevelled edge of the gate member to provide a single line gate seating contact with the beveled knife edge of said gate when said valve is closed, and a circular groove in the seating surface of said gate seating member to prevent direct contact between the gate seating member and the edge of said gate.

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